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Smithfield Show

Tropical Crops

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WORLD CROPS

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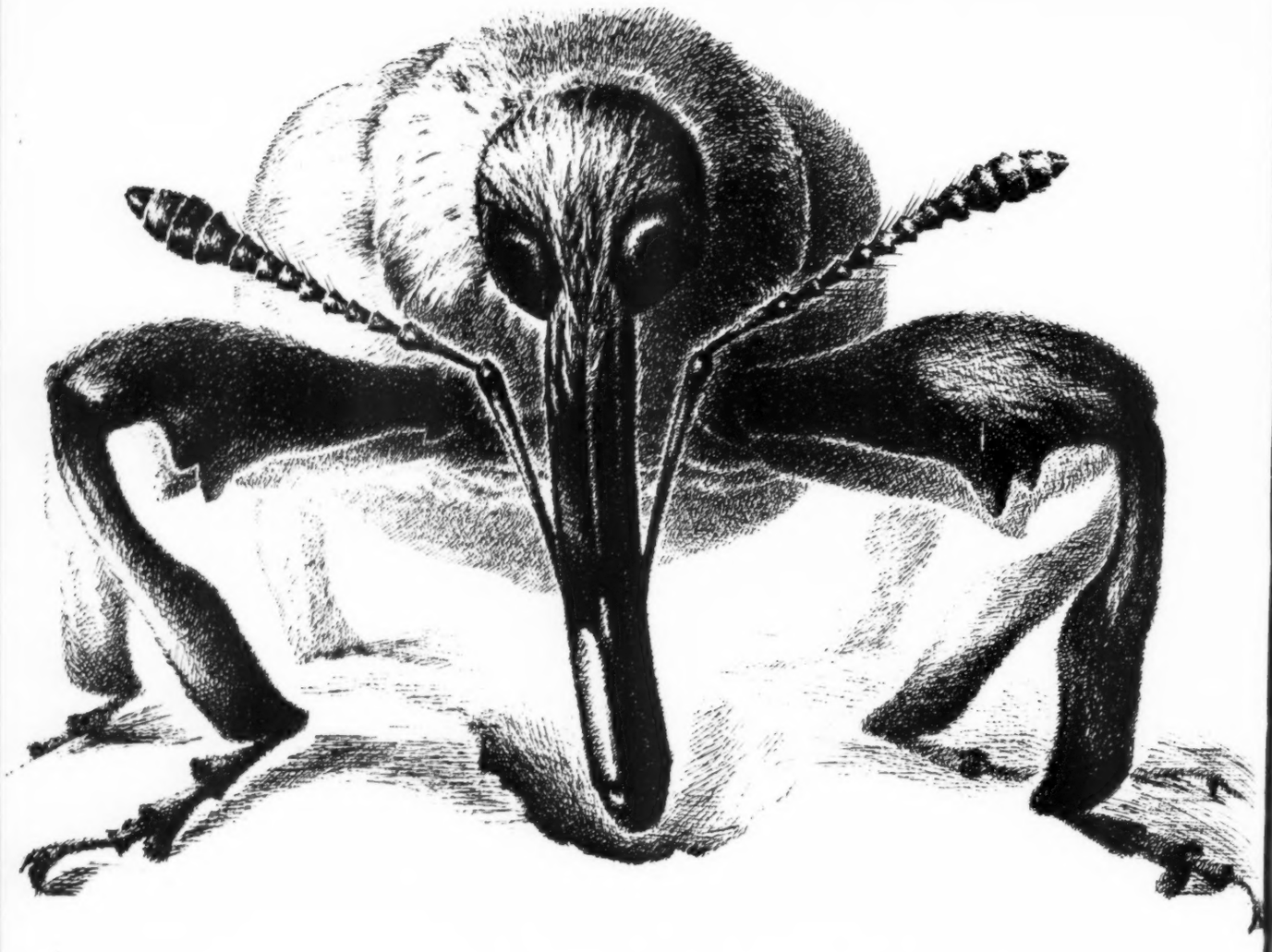
Photo: Aichi Prefecture Horticultural Experiment Station

Boron deficiency has led to poor growth and failure to flower in the Japanese Winter Radish plants on the extreme left. By contrast, application of a boronated fertiliser has ensured healthy growth in plants at centre and right. *See page 460*

A Publication of The Leonard Hill Technical Group



The Bandit of the Cotton Plantations

The Picudo has a world-wide reputation of being one of the most dangerous cotton thieves in existence. Entomologists know it under the name of Anthonomus spec. It is alleged to be the most important cotton pest of the American Continent where it still today destroys between 20 and 40% of the harvest. We only need to make a casual study of its crime-sheet to realise what disastrous losses are inflicted by this arch-enemy of cotton. The vital importance of cotton to world trade is illustrated by the fact that this crop, with an annual yield of 10 million tons, supplies three-quarters of all textile fibres produced throughout the world.

For the Picudo the expansive cottonfields are a real El Dorado, providing inexhaustible feeding grounds. Anyone who has once witnessed how this weevil attacks the plant with its proboscis, and how the larvae destroy one boll after the other, will no longer have any doubt that this pest is a very dangerous enemy. It multiplies in huge numbers; in favourable weather conditions the cycle from egg to adult takes only 2 to 3 weeks. There may be seven generations a year.

In the battle against this major pest, all depends upon the use of the right insecticide. The cotton grower relies upon

Folidol

for he knows that agriculturists all over the world have already been using this product for many years past, thus proving its excellent efficacy. With the development of Folidol by Farbenfabriken Bayer, a new epoch of modern pest control began. Farbenfabriken Bayer were the first to discover the extraordinarily powerful effect of the phosphoric ester against noxious insects. The success of Folidol is also largely due to its very wide spectrum of activity and its excellent tolerance to plants.

Folidol is an indispensable aid in the battle against the Picudo and numerous other pests on all agricultural crops.

CUPRAVIT, copper spray
POMARSOL, TMTD spray
FOLIDOL, E 605, methyl parathion, ethyl parathion
METASYSTOX, SYSTOX, systemic insecticides
DIPTEREX, GUSATHION, new type insecticides
HEDONAL, herbicide
TUGON, fly killer

Seed dressings

of all types for all uses
(mercury hexachlorobenzene, TMTD, COBH)

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Editorial Comment

Progress in Spraying

THE total acreage of crops sprayed for pests and diseases is not known but, according to the Association of Agriculture, one estimate states that 341,000 acres out of about 571,000 acres of potatoes in England and Wales are regularly sprayed for the control of potato blight.

Another useful deduction can also be arrived at from the fact that 88% of British farmers with over 100 acres are stated to be spraying three-quarters of their total acreage of cereals. This means that roughly 4 million acres of cereals out of the 7 million in the U.K. are being treated with chemical weedkillers at the present time.

Thinking in Millions

Crop losses due to specific pests are very difficult to assess, for so seldom is there a single cause; it is quite obvious that the losses due to insects, diseases and weeds must run into many millions for Britain alone, and for the world as a whole must amount to billions of pounds. Some time ago, it was estimated that in the U.K. the annual loss amounted to £88 millions.

An official U.K. estimate has put potato losses between 1948 and 1956 from potato blight alone at 7.8% of the total harvest and potato root eelworm causes some £2 million worth of damage every year. Losses of sugar beet through virus yellow disease has averaged 0.92 tons per acre. This is equivalent to 400,000 tons of sugar, or, otherwise expressed, ½ lb. of sugar per person per day.

Losses through weeds are obviously very difficult to assess, though one authority has put the annual loss in Britain at £50 million. The results of chemical weed control, however, indicates clearly the benefit to be obtained. Much depends on the original degree of infestation, but experiments have shown yield increases for wheat ranging from 3-64% for fields, variously infested. The overall average for yield increases from weed control was 25%.

Complete Mechanisation

THE Agricultural Engineers' Convention at Brighton this year was an unqualified success and the boisterous spirit of the gathering reflected the dynamic optimism of an industry with a tremendous impact on world agriculture.

The Mayor of Brighton, Alderman A. J. M. Johnson, J.P., in an amusing speech, agreed that the agricultural engineers of Britain had indeed transformed agriculture, but he thought that one thing still remained to be done before a state of full mechanisation could be claimed. He suggested that with only a few simple attachments the modern combine harvester could be made to produce baked, wrapped and sliced loaves and deliver them into an accompanying van. Our artist, Mr. A. E. Beard, has, however, anticipated him—see the cartoon on page 371 of our October issue.

Our Daily Diet

CALORIES ARE very much in the news. From the latest *Production Yearbook*,* published by FAO, we learn that the Irishman's dinner table is the most heavily laden in the world. The figures show that he gets 3,500 calories of food a day; next comes the New Zealander with 3,430 and the Dane with 3,350; fourth on the list is the Englishman with 3,260 calories, followed by the Australian with 3,200, the Swiss with 3,180 and the Canadian with 3,110. Surprisingly, the Americans and the Argentinians—both large producers of wheat—have a net food supply of 3,110 each. Three other countries with a calorie supply of 3,000 and above are Norway, Finland and Austria.

At the other end of the scale, there is India with the smallest supply of calories per head—only 1,800. Her neighbour, Pakistan, is slightly better off with 2,010 per head. In Africa and the Near East, Turkey is top with 2,890 and Israel is next with 2,750. In the Far East, Taiwan (Formosa) leads with 2,330 calories and Japan is next with 2,220 calories.

The availability of sufficient calories does not necessarily mean that a nation's diet is well balanced, as explained by Dr. Norman Wright when he addressed the British Association of Science—see WORLD CROPS, November 1960.

Apart from cereals, which are the biggest single item on every national diet, the statistics show that the Irishman's calory supply comes from milk, fats, meat and sugar in that order; on the other hand the New Zealander's preferences appear to be meat, milk, fats and sugar and the Danes place fats first, followed by meat, sugar and milk.

An important point about these statistics is that the figures are averages obtained by dividing calories, home-produced or imported, by the population estimates. Thus, although the average for Britain may be 3,260 calories, a manual worker will consume as much as 4,500 calories, while a sedentary worker may only require 2,500 a day.

By the same token, the position in India is indeed far more grim than is indicated by an average calorie intake

* Production Yearbook, Vol. 13, Pub. by FAO, Rome, Italy. 1960. Price $5.00 or 25s.

of 1,800. For some—in fact for the majority—the daily food intake may be less than 1,500. It is quite possible to exist for long periods in inactivity in a warm climate on even less. We, ourselves, existed for three months in a prison camp at Kranji on Singapore Island on quarter rations, *i.e.* on a diet ranging from 1,100-1,400 calories per day, consisting of rice and greens, rice and greens, *ad nauseum*. The greens were sweet potato leaves and amaranthus leaves. Today, we are hale and hearty, and none the worse for the experience, but a lifetime on less than 1,500 calories would be but a brief and grim existence.

Synthetic Food

SYNTHETIC INDIGO, synthetic rubber, synthetic fibres, synthetic perfumes, synthetic flavours . . . and now synthetic chlorophyll. Chlorophyll—the green colouring matter in leaves—is the catalyst which brings about the process of photosynthesis, whereby solar energy is converted into chemical energy and carbon dioxide into carbohydrates—the starches, the sugars, the vegetable oils and the lignins—leading in the ultimate to coal and petroleum.

From a recent report it is learned that Professor Martin Strell and Dr. Anton Kalojanoff, of the Organic Chemistry Institute of the Munich Technical College, have succeeded in producing chlorophyll synthetically—both chlorophyll A (blue-green) and chlorophyll B (yellow-green)—as a result of 20 years' work in Munich, Basle and Massachusetts. These researches were a continuation of the work begun by a Nobel prize winner, Professor Hans Fischer, who died in 1945.

While it might at first thought appear that the world is over well supplied with chlorophyll, the real importance of the discovery lies in the fact that it could lead to the artificial production of sugars, starches and vegetable oils and so offer some solution to the growing food problems of the world by the production of the synthetic foods.

Pruning Tea

TEA PRUNING is a subject which has received little attention in East Africa, according to the Quarterly Circular of the Tea Research Institute.

The pruning of tea is a complex operation, involving the conversion of a two-year-old sapling – which left to itself would produce a tree about 30 ft. high – into a bush low enough to be hand-plucked by a man or woman walking round it. The bush so formed must thereafter be capable of giving a fairly steady growth of young leaf and, because of this, pruning procedure and plucking must be closely correlated.

A tea bush does not develop foliage at a steady rate, but in 'flushes' of five leaves or so, then the shoot rests for a time, unless stimulated by plucking. After a year or two such stimulation is insufficient to maintain a high crop, and the general stimulus given by light pruning is then necessary.

Other factors involved in the pruning and plucking procedure include climate, the variety of the plant, its manurial treatment and perhaps the shade canopy supplied by inter-planted leguminous trees.

Trial and Error

As long ago as 1860 in North-East India, when much of the tea planted was of the China and hybrid varieties, the only pruning done was the removal of dead wood with a billhook and occasional trimming with garden shears. About 1870, centring of the bush was advocated and pruning saws and knives were introduced. It was soon realised that a bush full of twigs in the centre needed nourishment, but it was still thought that matters could be put right by heavy pruning. By 1900 heavy pruning was considered a necessary evil and this idea persisted till 1920, when collar-pruning was still general. This was followed by biennial cut-back to 6, 12 and 16 in. with a view to building up the frame. As many as 50% of the bushes died under this treatment, whilst the survivors were generally heavily cankered. In an attempt to reduce these losses, 'kickers' or side branches were left, a system reintroduced into Ceylon many years later under the name of fringe or rim-lung pruning.

In 1920 the systematic replanting of tea began in Assam and the poorer types were replaced by good Assam and Manipuri plants, selected for natural spread and vigour. At the same time, the scientific study of pruning was taken up at Tocklai. As a result, collar pruning and heavy pruning were abandoned, and now the sapling, a year after planting, is lightly centred and cut across at 18 in., its lowest cut ever. The young bush is plucked level when it attains a height of 30 in.

The habit of plucking 'above a leaf,' thereby developing a concave surface to the bush and a steadily rising table, was discontinued. This procedure, curiously enough, it still followed in Ceylon, coupled with fairly heavy pruning.

Assam Practice

The bush in Assam is usually pruned annually, the cut rising by 2 in. in the early years and later by ½ in., so that in 25 years the pruning table may be about 30 in. high. The bushes are then cut back to 24 in. or so, after which the cut is raised again each year for another 15 years, when it is time to uproot and replant. Plucking is never closer than 6 in. above the cut, and never lower than 28 in. above ground level.

In some cases the pruning is given biennially with an unpruned year between. In others a 'skiff' or light cut across is given in alternate years. Even a three-

year cycle—prune, unpruned, skiff may be employed on occasion.

With the pruning and plucking treatment described, the bushes are heavily manured with sulphate of ammonia applied at 80 to 100 lb. N per acre and generously shaded. Following such treatment in Assam, replanted areas in the tenth year, put out from commercial seed, will yield over 2,500 lb. fine tea per acre under plantation conditions.

In Java and in Nyasaland, methods similar to those described above are used with success; the estates of East Africa could not do better than follow the Assam system, adapted to suit local conditions.

Planning and Quotas

THE CENTRALISED planning of quotas of production of annual crops, where over-production is occurring, would appear to be a sound economic measure for avoiding a succession of gluts and shortages, with the consequent fluctuations in price which follow.

Where, however, weather conditions are an unknown variable and the effect on yields is considerable, it is obviously not sound to base quota allocations on basic acreage as a means of controlling supplies coming forward. Unless the weather can be accurately predicted, potato quotas based on acreage are complete nonsense, according to Mr. Jack Merricks, a Sussex farmer.

In a recent communication to WORLD CROPS, he stated that the variation in average yield for potatoes between good and bad years may be as much as two tons per acre. He also pointed out that another 'unknown' is the tonnage of potatoes which will be imported in 1961, so that it would be equally impossible to control prices, except by edict.

Perhaps his most important objection is the technical one that the centralised planning of potato production interferes with the system of rotational cropping, and does harm to agriculture by tending to prevent farmers from using their land to the best advantage, for it may well lead to keeping land under potatoes, in spite of soil exhaustion resulting from single-crop cultivation and of the build-up of the eelworm population in the soil. Farmers who have got 'clean' land have either not got an adequate quota or they have no quota at all, as there is no provision for the exchange or sale of quotas—a system that worked so satisfactorily in the case of the rubber industry in Malaya.

International Rice Research

AGREEMENT HAS been reached between the Government of the Philippines, the Ford Foundation and the Rockefeller Foundation for the establishment of an International Rice Research Institute at Los Banos, Laguna. The Government will provide the site of about 55 ha., adjacent to the College of Agriculture of the University of the Philippines; the Ford Foundation will make a capital grant of about $6 million to meet the cost of constructing and equipping the buildings; while the Rockefeller Foundation will pay the operating costs, be responsible for developing the programme of the Institute and the selection of the administrative and scientific staff.

Recent appointments to the Institute include that of Dr. Robert F. Chandler, jun., as Director and a Board of Trustees consisting of representatives of the two Foundations and the Government of the Philippines, together with members from Thailand, India, Japan and Taiwan.

The Director has stated that the aims of the Institute will be to conduct research and train scientists, to distribute improved planting material to regional and international research centres, to establish and operate an information centre and library, and to organise conferences for the purpose of discussing current problems.

We have already pointed out the need for such an organisation (see WORLD CROPS, 1960, 12, 85) and, while the present proposal is most welcome, we feel that membership of its Board should be more representative of research workers throughout the world. Further, in view of the international status of the Food and Agriculture Organisation of the United Nations

'Personally I'd never eat fruit or vegetables that have been drenched with chemicals'

and the valuable contributions of this body towards research on all aspects of rice production, distribution and consumption, we suggest that close liaison with FAO will be found essential to prevent undesirable duplication of work.

Natural Rubber v. Synthetic

THE ANSWER to the question 'When we produce natural rubber in the most economical way possible can it meet the challenge of the newer synthetics?' is 'Yes, provided we continue our fundamental research and our technical development in the right direction'. This is what Prof. G. Gee of Manchester University told 300 delegates from 20 countries during the closing stages of the Natural Rubber Research Conference at Kuala Lumpur, the Federal capital of Malaya.

In some quarters, it has been felt that the days of natural rubber were numbered, but in his summing up Sir Geoffrey Nye, Controller of Rubber Research in Malaya, was quite emphatic. He pointed out that no single elastomer* is supreme in all respects, for each has its own special characteristics and special uses. In the ever-expanding market for elastomers, remarkable developments are made possible by blending natural rubber with synthetic in various ways.

The production cost of natural rubber, too, is being steadily reduced by the replacement of old stands with new high-yielding clones giving yields of the order of 900-1,000 lb. of dry rubber per acre—three times as much as in the 1930s. In closing the conference, the Hon. Inche Cheam Theam Swee, Assistant Minister of Commerce and Industry in Malaya, actually said he looked forward to the time when yields of up to 2,000-3,000 lb. of rubber per acre per annum would be obtainable. This means, in other words, that the cost of production can be steadily reduced.

The contributions at this conference emphasise that research and technical developments can still make tremendous contributions in improving and controlling the properties of natural rubber and in reducing production costs by increasing yields. Research must go on and be intensified and then there need be no fear for the future of natural rubber.

Wild Rice

IN MANY parts of the world, notably in North and South America, numerous varieties of wild rice possessing a red pericarp or seed coat have become so rampant that they are now looked upon as the most serious of weed pests in paddy, comparable with wild oats in Britain. The menace of red rice has for some years caused much concern in British Guiana. It has recently been stated that contamination in the field in that country is sometimes as high as 90%.

Investigations to discover ways and means of bringing red rice under control in British Guiana were conducted by E. G. Giglioli between 1951 and 1956, the results of which he has published in an interesting report†. Mr. Giglioli states that red rice matures 10-14 days before the commercial varieties, it exhibits a very high degree of grain shedding on ripening, thus infesting the land with seed which will develop with subsequently planted paddy, and it is hardier than the cultivated varieties amongst which it flourishes, so that its seed will remain viable in the soil for a considerable period. These features play an essential role in the build-up and spread of red rice in the paddy crop. In the mill, red rice causes further loss, for it requires harder milling to eliminate the red seed coat, thus causing milling difficulties and resulting in more broken grain and undesirable by-products.

Mr. Giglioli attempted control by repeated off-season cultivation, prolonged grazing of volunteer growth by cattle, application of weedkillers, wet cultivation under strict water control and deep cultivation. He found that excellent control of red rice was achieved by wet cultivation, but that the technique has many disadvantages and is uneconomic. Deep ploughing also gave encouraging results and is worthy of further investigation.

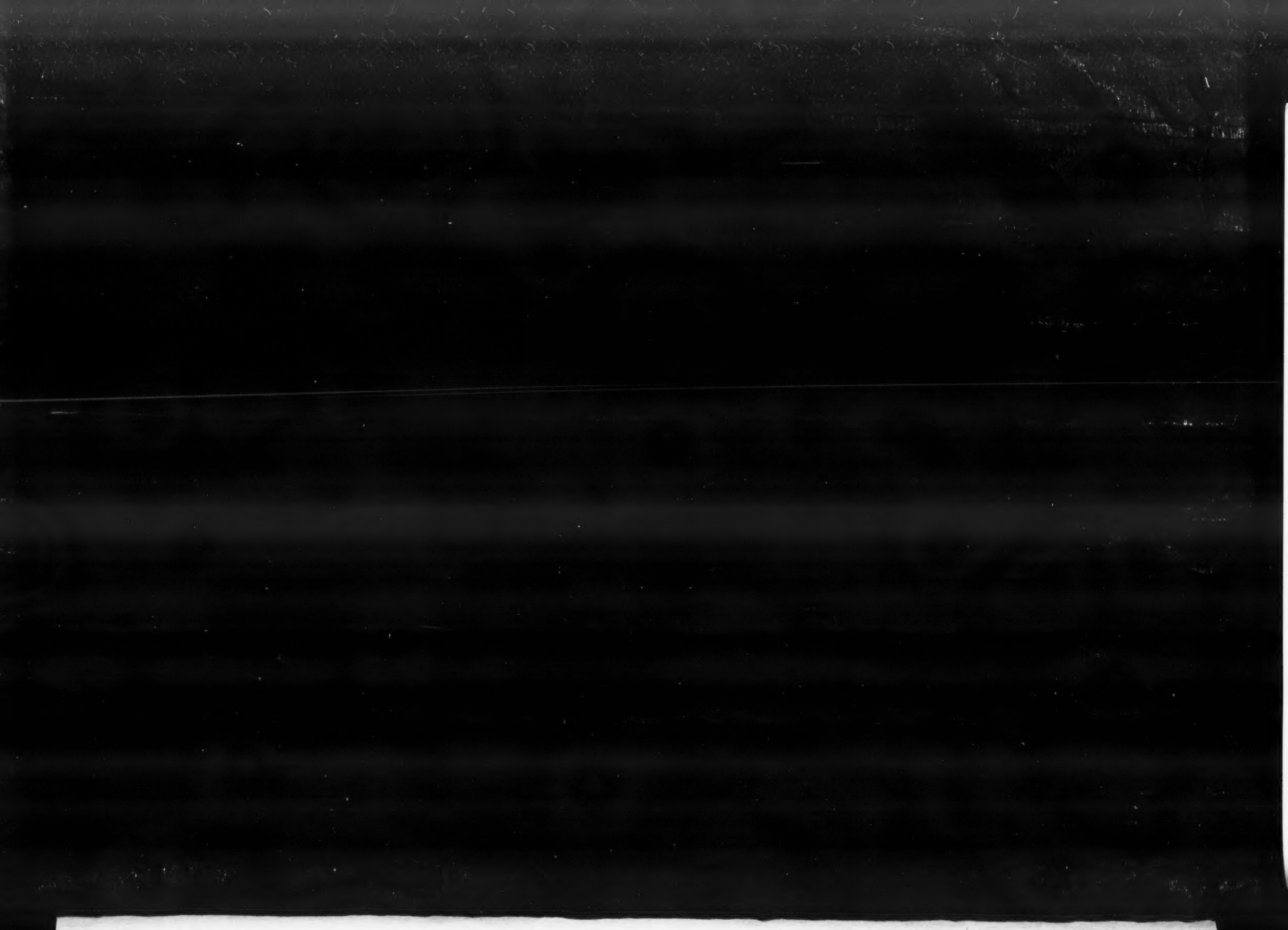
The authorities in British Guiana appear to have given very close attention to this problem and Mr. Giglioli's work has gone far to clarify the position, but we do not think that the investigations are sufficiently conclusive to warrant a campaign to make farmers more conscious of the weed and to teach them the methods which should be used for its eradication, as advocated in a recent number of *The Rice Review*, published by the British Guiana Rice Producers' Association.

The Botanical Answer

One aspect of the problem appears to have escaped attention in British Guiana. It is stated by Mr. Giglioli and others that there are many types of red rice, but that they all mature about a fortnight before the commercial varieties amongst which they grow. If this fact is indeed established beyond doubt and applies to all the varieties of red rice in the region, it provides the key to the solution of the problem. All that is necessary is to replace existing commercial varieties by others having a maturation period shorter than that of red rice, thus denying the latter an opportunity to ripen seed. This would result in harvesting the crop before instead of after the red varieties matured. It follows that if this were done for a few years it would result in the complete elimination of red rice.

* Elastomer: A material, usually synthetic, having elastic properties akin to those of natural rubber, *e.g.* butyl rubber.

† *Red Rice Investigations*, by E. G. Giglioli. British Guiana Rice Development Co. Ltd. and Department of Agriculture, British Guiana. Mimeographed. Undated.



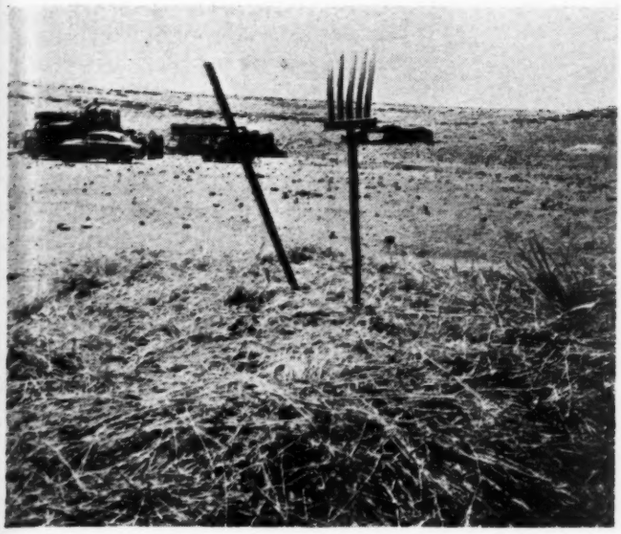


Photo: Inter-Church Aid

Left: *The pitifully small harvest obtained by a Bedouin tribe in the summer of 1959. In the background there is a Drought Relief team.* Right: *Bedouin family leaving the area of Kasr El Halabat for fresh pastures. The name means 'Place of the Milkers', but last year there were no pastures. The soil is flat and fertile, but without rain or sources of water it cannot produce crops or pastures*

Feeding the World's Millions—2

N. C. WRIGHT, C.B., M.A., D.SC., PH.D.*

In part 1, the author considered the adequacy of current food supplies. Now he goes on to consider whether the trend of world food production is sufficient to meet future requirements. He concludes by urging that there should be greatly increased production of food in those areas which are at present deficient.

CONTRARY to widely held belief, available statistics indicate that world food production is currently increasing at a slightly faster rate than world population. Nevertheless, this statement needs qualification, for the production increases are not uniform.

For example, food production per head has increased by more than 40% over the pre-war level in Eastern Europe (including the U.S.S.R.), by 15-20% in Western Europe and North America (in spite of acreage control and other limitations), and (encouragingly) by 10% in the Near East. On the other hand, food production per head in Latin America, Africa and the Far East (including China) is estimated still to be slightly less than before the war.

These inadequacies in production, when coupled with some rises in in-

Members of the Drought Relief team distributing two months' supply of flour, fats, sugar and tea to the Bedouins through funds supplied by the British Council of Churches

* Deputy Director-General, Food and Agriculture Organisation of the United Nations.

As the world's population increases it becomes necessary to reclaim desert areas such as this and to search for water which is the essential requirement for plant growth. Here, marram grass is being used to anchor the soil and allow the vegetation to spread

come and demand, have, however, brought about certain changes in international trade in food. Exports of food from the less-developed regions of the world have fallen to about one quarter of their pre-war level. Indeed, many of the less-developed countries are now food importers. Taking these changes into account, recent estimates suggest that in the last few years the average consumption of food in the less-developed countries has probably risen slightly above the low pre-war level. Any such improvement is, however, almost negligible in relation to needs.

Moreover, there are wide variations between countries. Indeed, since 1952–53, food production has appreciably exceeded the growth of population in little more than half the countries for which relatively reliable statistics are available, though in a few the growth of production has been most rapid and impressive.

These estimates refer to the current trends. A more crucial question is whether these trends can keep pace with the accelerating growth of the world population. Even if it did, the present production figures are themselves related to diets which are so insufficient as to lead to the undernutrition or malnutrition of a large proportion of the world's population.

In any estimates of future requirements we have, therefore, not only to make allowance for the needs of the rapidly increasing population, but also to make good existing deficiencies.

Future needs

Based on the existing dietary level in the more-developed countries, and on a reasonably improved level in the less-developed countries, it may be roughly assumed that, for every future increase of 100 million in the population, the world will need to provide a total of about 13 million tons of additional cereals and about 14 million tons of animal products—milk, meat, eggs and fish.

If allowance is also made for bringing the present world diet up to a reasonable level, it appears that by 1980 we shall have to increase the world's cereal production by not less than 33% and double the world's production of milk, meat, eggs and fish. These figures are based on a 1980 world population of just over 4,000 million, compared with just under 3,000 million now.

By the year 2,000—if the world population should reach the U.N. forecast of about 6,000 million—the needed increases will have risen to over 100% for cereals and over 200% for animal products. To achieve a fully adequate level for all countries, the latter figure would indeed have to be stepped up to 300% or more. It is inconceivable that such increases could be met if world food production merely follows the present slow upward trend.

It has sometimes been suggested that such increases could be secured either—on a short-term basis—by the distribution to scarcity areas of the surpluses produced in the more-developed countries, or—on a long-term basis—by the world-wide adoption of vegetarian diets.

Utilisation of food surpluses

One of the most striking aspects of world food supplies since 1952 has been the accumulation of substantial stocks of surplus grain which have now reached the unprecedented figure of over 125 million tons. It is true that considerably less than half of this quantity consists of wheat, the stocks of which have only increased by about 6 million tons since 1954, and have been stationary for the past two years.

Nevertheless, coarse grains, which comprise barley, oats, maize and sorghum, and which have accumulated at an average rate of over 6 million tons each year, are the staple cereals used for human consumption in a number of underdeveloped countries and might, therefore, in theory at least, be utilised to supplement the existing food supplies in areas of food scarcity.

Calculations indicate that, if so utilised, they could—again in theory—supply the full calorie needs of about 450 million people for a year, or furnish 100 calories a day to the world population, or 200 calories a day to the Asian population for a period of more than three years.

Nevertheless, there would clearly be insuperable difficulties in achieving such a widespread distribution if it were ever seriously considered. Apart from the organisational problems involved, the disposal of such a huge quantity of grain—representing almost twice the world's annual exports of wheat and almost four times the exports of coarse grain—would so disturb the normal channels of trade as to menace the economic position not only of the other exporting countries but even of the recipient countries themselves.

Moreover, the present grain surplus represents an accumulation spread over some eight to ten years. Once it has been distributed, the world could only rely in the future on an annual surplus of the order of perhaps 10 million tons. When it is realised that the total grain production of the world reaches a figure of well over 800 million tons, the relative insignificance of this figure, representing only about 1% of total grain production, is apparent.

There are also other factors to be taken into account. Firstly, there are many areas where rice, and not wheat or coarse grains, is the staple cereal. Populations are notoriously conservative in their food habits, as the disappointing experience of attempts to relieve famine conditions by the distribution of wheat to rice-eating areas has repeatedly demonstrated. It would require a major revolution in the dietary patterns of such areas to enable the distribution of surplus grains to affect appreciably their calorie levels.

Secondly, while it is true that undernutrition is widespread, malnutrition is a no less serious cause for concern. But to alleviate malnutrition what are required are protein-rich foods, not cereals. Examination of the world's total food stocks indicates, however, that while in 1959 the total grain surplus was over 120 million tons, that of the protein-rich foods, comprising condensed, evaporated and dried milks (but excluding cheese, which is unsuited to the diets of most of the less-developed countries in the tropics) was only about 120 thousand tons. Indeed, the quantities of the latter were so limited that only a year ago a single bad grazing season in Europe seriously menaced the whole programme of UNICEF's supplementary feeding schemes.

Thirdly, while in a normal run of years a surplus of cereals may be anticipated, two or three successive bad seasons in the surplus-producing countries could easily provide no annual surplus at all.

It is not intended to imply that surpluses produced in the more developed areas should not be used for the benefit of the less developed. Such surpluses have already been used in the relief of the recent famines and severe food shortages in the provision of supplies for supplementary feeding schemes, and in the agreement between the U.S.A. and India for the supply, over the next four years, of no less than 16 million tons of wheat and one million tons of rice.

It is also not implied that food surpluses should not be used to provide interim aid to deficit areas during the periods when improved techniques have still to make their full impact on the production of more adequate local food supplies. But, for the reasons stated, *such surpluses never should, and never could, be relied upon to provide a long-term solution to the world's food supply problems.*

Adoption of vegetarian diets

The second suggested panacea is the universal adoption of vegetarian diets. The protagonists of this solution point out that the production of animal products for human food is a wasteful process in that, in the course of conversion of plant into animal tissues, no less than six-sevenths of the available calories in the plant are lost. By utilising the plant tissues as direct human food, man will therefore, they claim, substantially increase his food resources. Nevertheless, this fails to take into account several important factors.

Thus domesticated animals do not, in general, compete with man for the same plant nutrients. In Britain, grass and grass products furnish nearly 60% of the nutrients for all livestock; in India (to take an example from a widely different environment) dry and green fodders provide 95% of such nutrients; and in Africa and the Near East and other arid and semi-arid areas, the cattle, sheep and goats subsist largely on natural herbage, grazed nomadically.

Moreover, even where man and animals might be considered competitors, the livestock are, in fact, usually the consumers of the inedible by-products. Thus, while man consumes the refined flour of the wheat grain, animals subsist on the coarser milling offals and the straw; where man derives his margarine from oilseeds, animals utilise the unpalatable cake and meal; where man extracts his sugar from the beet, animals thrive on the rejected tops and pulp; and where man selects the choice portions of the carcass, animals fulfil the role of scavengers in disposing of the offals of the slaughter-house.

The Harvest of the Sea. Cereals alone do not provide a balanced diet; animal products and fish are required to provide the necessary proteins. India is one of the world's leading fish-producing nations. Instruction is being given by FAO in the operation of small-powered fishing boats and the handling of modern fishing gear

Moreover, in their passage through the animal, the proteins of such materials are not only improved in quality, resembling more closely in pattern those constituting the human tissues, but are present both in far higher concentration and in more readily available form than in the plant.

The protein content of the dry matter of grass ranges, for instance,

As the world's population increases it becomes necessary to reclaim desert areas such as this and to search for water which is the essential requirement for plant growth. Here, marram grass is being used to anchor the soil and allow the vegetation to spread

come and demand, have, however, brought about certain changes in international trade in food. Exports of food from the less-developed regions of the world have fallen to about one quarter of their pre-war level. Indeed, many of the less-developed countries are now food importers. Taking these changes into account, recent estimates suggest that in the last few years the average consumption of food in the less-developed countries has probably risen slightly above the low pre-war level. Any such improvement is, however, almost negligible in relation to needs.

Moreover, there are wide variations between countries. Indeed, since 1952–53, food production has appreciably exceeded the growth of population in little more than half the countries for which relatively reliable statistics are available, though in a few the growth of production has been most rapid and impressive.

These estimates refer to the current trends. A more crucial question is whether these trends can keep pace with the accelerating growth of the world population. Even if it did, the present production figures are themselves related to diets which are so insufficient as to lead to the undernutrition or malnutrition of a large proportion of the world's population.

In any estimates of future requirements we have, therefore, not only to make allowance for the needs of the rapidly increasing population, but also to make good existing deficiencies.

Future needs

Based on the existing dietary level in the more-developed countries, and on a reasonably improved level in the less-developed countries, it may be roughly assumed that, for every future increase of 100 million in the population, the world will need to provide a total of about 13 million tons of additional cereals and about 14 million tons of animal products—milk, meat, eggs and fish.

If allowance is also made for bringing the present world diet up to a reasonable level, it appears that by 1980 we shall have to increase the world's cereal production by not less than 33% and double the world's production of milk, meat, eggs and fish. These figures are based on a 1980 world population of just over 4,000 million, compared with just under 3,000 million now.

By the year 2,000—if the world population should reach the U.N. forecast of about 6,000 million—the needed increases will have risen to over 100% for cereals and over 200% for animal products. To achieve a fully adequate level for all countries, the latter figure would indeed have to be stepped up to 300% or more. It is inconceivable that such increases could be met if world food production merely follows the present slow upward trend.

It has sometimes been suggested that such increases could be secured either—on a short-term basis—by the distribution to scarcity areas of the surpluses produced in the more-developed countries, or—on a long-term basis—by the world-wide adoption of vegetarian diets.

Utilisation of food surpluses

One of the most striking aspects of world food supplies since 1952 has been the accumulation of substantial stocks of surplus grain which have now reached the unprecedented figure of over 125 million tons. It is true that considerably less than half of this quantity consists of wheat, the stocks of which have only increased by about 6 million tons since 1954, and have been stationary for the past two years.

Nevertheless, coarse grains, which comprise barley, oats, maize and sorghum, and which have accumulated at an average rate of over 6 million tons each year, are the staple cereals used for human consumption in a number of underdeveloped countries and might, therefore, in theory at least, be utilised to supplement the existing food supplies in areas of food scarcity.

Calculations indicate that, if so utilised, they could—again in theory—supply the full calorie needs of about 450 million people for a year, or furnish 100 calories a day to the world population, or 200 calories a day to the Asian population for a period of more than three years.

Nevertheless, there would clearly be insuperable difficulties in achieving such a widespread distribution if it were ever seriously considered. Apart from the organisational problems involved, the disposal of such a huge quantity of grain—representing almost twice the world's annual exports of wheat and almost four times the exports of coarse grain—would so disturb the normal channels of trade as to menace the economic position not only of the other exporting countries but even of the recipient countries themselves.

Moreover, the present grain surplus represents an accumulation spread over some eight to ten years. Once it has been distributed, the world could only rely in the future on an annual surplus of the order of perhaps 10 million tons. When it is realised that the total grain production of the world reaches a figure of well over 800 million tons, the relative insignificance of this figure, representing only about 1% of total grain production, is apparent.

There are also other factors to be taken into account. Firstly, there are many areas where rice, and not wheat or coarse grains, is the staple cereal. Populations are notoriously conservative in their food habits, as the disappointing experience of attempts to relieve famine conditions by the distribution of wheat to rice-eating areas has repeatedly demonstrated. It would require a major revolution in the dietary patterns of such areas to enable the distribution of surplus grains to affect appreciably their calorie levels.

Secondly, while it is true that undernutrition is widespread, malnutrition is a no less serious cause for concern. But to alleviate malnutrition what are required are protein-rich foods, not cereals. Examination of the world's total food stocks indicates, however, that while in 1959 the total grain surplus was over 120 million tons, that of the protein-rich foods, comprising condensed, evaporated and dried milks (but excluding cheese, which is unsuited to the diets of most of the less-developed countries in the tropics) was only about 120 thousand tons. Indeed, the quantities of the latter were so limited that only a year ago a single bad grazing season in Europe seriously menaced the whole programme of UNICEF's supplementary feeding schemes.

Thirdly, while in a normal run of years a surplus of cereals may be anticipated, two or three successive bad seasons in the surplus-producing countries could easily provide no annual surplus at all.

It is not intended to imply that surpluses produced in the more developed areas should not be used for the benefit of the less developed. Such surpluses have already been used in the relief of the recent famines and severe food shortages in the provision of supplies for supplementary feeding schemes, and in the agreement between the U.S.A. and India for the supply, over the next four years, of no less than 16 million tons of wheat and one million tons of rice.

It is also not implied that food surpluses should not be used to provide interim aid to deficit areas during the periods when improved techniques have still to make their full impact on the production of more adequate local food supplies. But, for the reasons stated, *such surpluses never should, and never could, be relied upon to provide a long-term solution to the world's food supply problems.*

Adoption of vegetarian diets

The second suggested panacea is the universal adoption of vegetarian diets. The protagonists of this solution point out that the production of animal products for human food is a wasteful process in that, in the course of conversion of plant into animal tissues, no less than six-sevenths of the available calories in the plant are lost. By utilising the plant tissues as direct human food, man will therefore, they claim, substantially increase his food resources. Nevertheless, this fails to take into account several important factors.

Thus domesticated animals do not, in general, compete with man for the same plant nutrients. In Britain, grass and grass products furnish nearly 60% of the nutrients for all livestock; in India (to take an example from a widely different environment) dry and green fodders provide 95% of such nutrients; and in Africa and the Near East and other arid and semi-arid areas, the cattle, sheep and goats subsist largely on natural herbage, grazed nomadically.

Moreover, even where man and animals might be considered competitors, the livestock are, in fact, usually the consumers of the inedible by-products. Thus, while man consumes the refined flour of the wheat grain, animals subsist on the coarser milling offals and the straw; where man derives his margarine from oilseeds, animals utilise the unpalatable cake and meal; where man extracts his sugar from the beet, animals thrive on the rejected tops and pulp; and where man selects the choice portions of the carcass, animals fulfil the role of scavengers in disposing of the offals of the slaughter-house.

Moreover, in their passage through the animal, the proteins of such materials are not only improved in quality, resembling more closely in pattern those constituting the human tissues, but are present both in far higher concentration and in more readily available form than in the plant.

The protein content of the dry matter of grass ranges, for instance,

The Harvest of the Sea. Cereals alone do not provide a balanced diet; animal products and fish are required to provide the necessary proteins. India is one of the world's leading fish-producing nations. Instruction is being given by FAO in the operation of small-powered fishing boats and the handling of modern fishing gear

from 10% to about 20%; that of milk, cheese, eggs and meat ranges from 30% to as high as 50%. Again, while the proportion of fat in the dry matter of plant tissues seldom exceeds 5% and for the staple cereals is less than half this figure; in the dry matter of milk, the proportion is over 30%, in eggs over 40%, in cheese over 50%, and in meat over 60%.

This process of concentration applies also to the mineral constituents and vitamins, thus conferring on many animal products an exceptionally high value as protective foods. Indeed, it is the lack of adequate quantities of such animal products in the diets of many under-developed countries which is, as already indicated, one of the causes of deficiency diseases.

Finally, from an agricultural aspect, livestock play an essential role in maintaining and, indeed, in increasing soil fertility, and thus in conserving the natural resources of the land. This is not only in the direct contribution made to the soil by the return to it of the unassimilated plant nutrients in farmyard manure, but also in the adoption of the principle of mixed farming, the basis of most modern systems of intensive agricultural production.

For these reasons it does not seem possible to accept the thesis that the world-wide adoption of vegetarian diets could provide a rational solution to the greatly increased needs of the world's rapidly expanding population; indeed, it might well exacerbate the problem.

The only effective solution

If these arguments are accepted, it is clear that we can rely neither on the utilisation of food surpluses nor on the world-wide adoption of vegetarian diets to solve the world food problem. The only effective and long-term solution of this problem is to secure the necessary increase in food production within the less-developed countries themselves by the widespread application of the recent scientific and technical advances.

It will, of course, be necessary to dovetail these advances with increased capital investment, with improvements in economic incentives, with structural improvements in such basic factors as land tenure, with organisational improvements in the agricultural and related services and, above all, with increases in the purchasing power of the consumer. But from the physical and biological aspects, there is no reason why the food production of the less-developed areas should not be expanded to the extent necessary to meet the world's needs, at least to the end of this century.

In this connection, an examination of existing regional differences in crop yields, in livestock yields and in yields from inland and marine fisheries will serve to indicate some of the potentialities for improvement. Thus, to take two widely different staple crops, the average yields (expressed in 100 kg. per ha.) for wheat are for Western Europe 17, for North America 13, for Latin America 11, for the Near East 10, for the Far East (excluding China) 9, and for Africa only 6, while for rice they are for Western Europe 48, for North America 29, for the Near East 26, for the Far East (excluding China) 22, for Latin America 16, and for Africa only 10.

Although the ecological conditions in the different regions vary widely and might be expected to affect productivity, it is difficult to avoid the conclusion that the high yields obtained in Europe and in large areas of North America for both crops (and this is equally true for most other cereals and root crops) are largely attributable to modern improvements in the techniques of plant production. Moreover, the foregoing figures refer to regional averages; within such regions the differences found between individual countries are far more striking, in some instances three, four or even five-fold.

On the animal production side, the observed differences are no less dramatic. While it is almost impossible to assess accurately the working output of the cattle of a region in quantitative terms, and while it is difficult to compare meat or milk output separately, since statistics rarely distinguish beef from dairy cattle, it is possible to arrive at a single unit of comparison which combines the production of milk and meat per head of cattle.

For Europe, this unit works out at between 1.6 and for North America 1.3. In comparison the figure for Latin America and the Near East is only 0.4, for Africa 0.24, and for the Far East 0.16—only one-tenth of that in the more developed regions.

Differences of the same order appear to be equally true for other classes of livestock—for mutton and lamb production, for pig production and for egg production where, for example, yearly output varies from 160 eggs per hen in the more advanced countries to less than 40 in the less advanced.

Again, in regard to fisheries, there has already been an increase in the world's catch from 20 million tons in 1950–52 to 34 million tons in 1958. But since three-quarters of the world's surface is covered by water, and since at present only about 10% of animal protein and about 1% of the world's total food supplies are derived from this source, there is still clearly very great scope for improving and expanding fisheries production.

Summary

This paper indicates the order of magnitude of the deficiencies in the world's current food supplies. Present trends in production are inadequate even to cope with current needs, and the only hope of bridging the gap lies in a greatly increased production of food in the present deficit areas. Inter-regional comparisons of food output clearly demonstrate that such increases in production are technically feasible.

An abridged version of the address given by Dr. Norman Wright, Deputy Director-General of FAO, to the 122nd Annual Meeting of the British Association for the Advancement of Science.

Ambassadors of Goodwill

The six Australian Young Farmers, the 1960 winners of the P. & O. 'Canberra' Award, left for home in the S.S. *Iberia*.

The award was instituted by Sir William Currie, former chairman of the P. & O., last year to provide a six month's study of farming methods in Britain, for the best farmer from each of the Australian States, selected by examination.

They have visited all the principal farming and farm machinery institutes in Britain, as well as the Shell Agriculture Station at Woodstock, the Doncaster Works of International Harvesters Ltd., the Chesterford Park Research Station of Fisons Pest Control, the Coventry Works of Massey-Ferguson Ltd., and a visit to the home of the Fordson Tractor at Dagenham.

Water Control in British Guiana

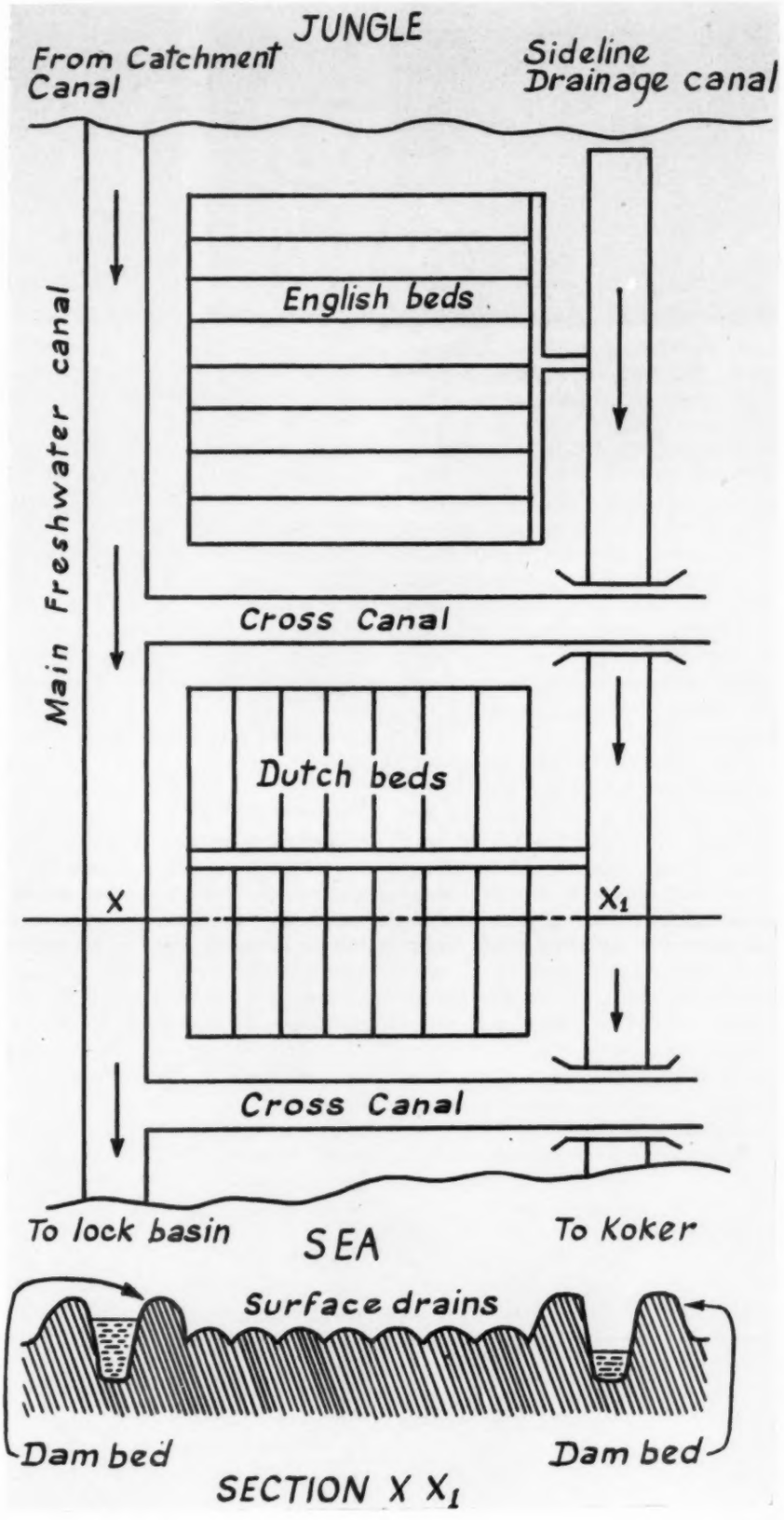
P. J. DOBBS, B.SC.(AGRIC.)*

This is an account of the system of water control, originally introduced by the Dutch, in order to convert saline coastal swamps into good agricultural land. Similar systems have since been adopted for the conversion of the mangrove swamps of northern Malaya into dry land, suitable for the cultivation of coconuts.

COMMERCIAL farming in British Guiana is confined to a narrow strip of land, less than 10 miles wide, extending along the coast, and for a short distance inland along the river banks. The area is heavily populated and intensively farmed.

The land is flat, and 4 or 5 ft. below mean sea level; the soil is silt and alluvial clay merging into an acid peat behind, further from the sea. Behind this narrow strip, there is dense rain forest, with undulating hills gradually increasing in size to the mountains and plateaux of Brazil and Venezuela, from which flow five large rivers and countless smaller streams and creeks. The rainfall on the coast averages about 100 in. per annum.

With these conditions, the importance of water control and drainage can readily be appreciated. Even if the sea is adequately protected from inundation by a sea wall and by diversion canals from floodwaters from the interior, there still remains the problem of hydrostatic pressure at every high tide, when there is a steady upward thrust on the soil water, which produces a highly saline subsoil.



Introduction of drainage works

Until 1831, the country was split into three colonies—Essequibo, Demerara and Berbice; today, these are counties under a central administration. Between 1600 and the Peace of Paris

* Field Technologist, Leonora Estate, British Guiana.

Left: *One of the mules drawing a line of punts, loaded with sugar cane, along one of the cross canals to the main freshwater canal.* Right: *A line of loaded punts in a cross canal passing over a sideline drainage canal, showing the difference in water level between the two*

in 1815, these colonies repeatedly changed between British and Dutch hands, and from 1782 to 1784 they were held by the French. In spite of these constant changes in control, it was in 1775 and 1776 that the first three major drainage canals were dug by a Dutch Commander of Demerara, Paulus Van Schuylanburg, and these remain today the nucleus round which the drainage system of Demerara has been developed.

The Dutch colonists have left many reminders of their stay, such as the plantation names, Schoon Ord and Uitvlugt, the rynland units of land measurement, and a scattering of abandoned windmills, but their most important legacy has been the founding of a system of land drainage which is as simple as it is effective. It is to the lasting and immeasurable benefit of the people of British Guiana today that their country was in the past under the administration of the most expert reclaimers of sea-inundated land in the world.

The drainage of British Guiana could never have been accomplished by small land-holders, working independently. The halycon days of the sugar industry, when the British West Indian islands were valued more highly than the whole Dominion of Canada, are gone; but before the continuous decline in profits set in, a large proportion of the Guiana coastline had been protected by sea walls and drainage canals.

The capitalistic rice farms, peasant holdings, and the cattle farms of Guiana are mostly to be found on abandoned sugar plantations, for at the close of the 18th century there were 280 sugar factories in the colony. Today, to a small extent by amalgamation, but mostly through abandonment, there are only 12. A host of small farmers now benefit from a highly developed system of water control which could not have been established without the capital and the knowledge available to the former large enterprises.

Water catchment

The cultivated strip is cut off from the jungle behind by a succession of large canals. Inland of these are the catchment areas where the reserves of water are built up during the wetter seasons of December to February, and May to July. No cultivation is allowed in these areas. There are a number of sluice-gates in these catchment canals through which the flow of water into each estate can be controlled.

On the coastal estates, this water is always uncontaminated and suitable for irrigation, but in the riverine estates of Berbice county it often carries in dry weather too high a concentration of salts to be used for this purpose, despite the high annual rainfall and flood application.

From the sluice inlets, the water flows slowly through a number of main canals towards the sea. These canals are used to transport fertilisers, planting material and supplies, take workers to the fields and bring cut cane back to the factories, which are always situated at the shore-side end of the estates. The cane-fields are in lines along either side of the main canals, and short cross-canals separate one field from the next. These cross-canals are used for loading the hand-cut cane into punts, holding about six tons each, which are tied together in lines and pulled by mules or tractors to the factory.

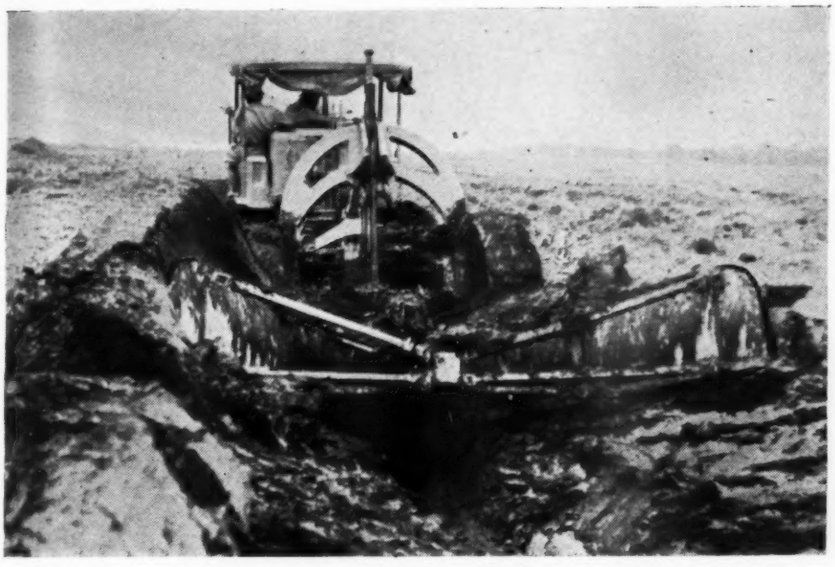
Flood fallowing

The canals may also be used for irrigation and it used to be the practice to flood the silty, saline, front-land clays for periods of up to a year before planting. While under water, the aerobic soil micro-organisms were destroyed and a population of anaerobic species was built up. These were, in turn, killed when the water was run out, and so a degree of sterilisation was obtained. Oxidation and reduction reactions also took place and a great improvement in soil structure and fertility resulted.

In this age of crawler tractors, it is now possible to plough heavy land fast and deep and this system of flood fallowing has gone out of fashion, as it is extravagant to leave land under water and out of production for so long. Flooding for short periods has proved valueless.

With 100 in. of rainfall, fairly evenly distributed over the year, irrigation of the growing crop has not been developed to any great extend, and there is nothing comparable to the Hawaiian system of routine irrigations following water tension measurements through-

out the estates. Freshly planted fields are sometimes flooded for a few hours, if the weather is dry, and today there are a few sprinkler units in the colony; it seems probable that much more attention will be paid to this aspect over the next two or three years. Fertiliser application, pest and disease control and varietal improvement have up to now been the main topics of study by the agronomists.



A Cuthbertson drain cutter, drawn by a Fawler tractor, making a field drain

Field drainage

As the soil has a high silt content, mole drainage is obviously impossible. The early Dutch planters imported tile drains, and these are sometimes turned up during cultivation, but today all estates rely entirely on surface drainage. The fields are shaped into high-cambered beds, about 37 ft. wide, running either parallel (English beds) or at right angles (Dutch beds) to the cross canals. Round the edges of each field, there is a continuous 'dam-bed', built up from the spoil from the canals, which prevents the main canal water from flowing over the fields direct into the surface drains between the beds.

These surface drains run in to a common field drain which leads through a small wooden sluice to the side-line drainage canal, running parallel to the main freshwater canals at the other end of the fields. These drainage canals have a water level from 3 to 8 ft. below that of the main freshwater canals and they join together at the bottom of the estate and pass through a koker† to the sea.

The watergates

Some of these kokers are self-acting; the doors are hinged at the top and rest at an angle against a concrete mounting, opening at low tide when the weight of the water on the landward side is greater than that on the seaward side, and closing when the pressures are reversed by the rise of the tide. The original Dutch kokers had heavy doors, sliding in grooves at either side, so that they could be raised or lowered by chains, attached to a spindle, which is revolved by a giant spoked wheel. Today, this is usually turned by a power winch, and some estates are drained by mechanical pumps.

The outflow of the main freshwater canal is made more complicated in the West Demerara estates by the fact that these are used by barges bringing supplies from, and taking sugar to, the port of Georgetown. It is consequently necessary to have a lock basin to enable these vessels to pass out to sea and to re-enter the canals to reach the factory.

Water control

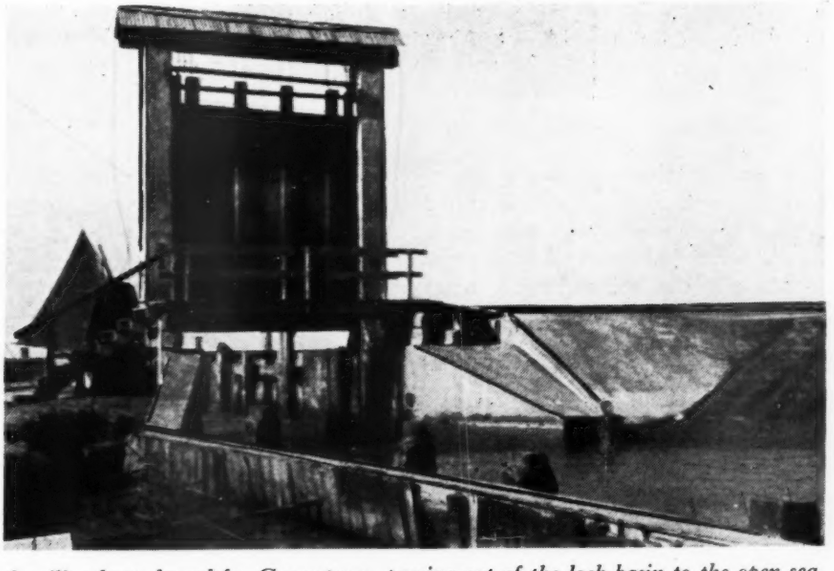
As the tide comes in, the basins are filled until they are at the same level as the main canals. The koker at the sea wall is then closed and the intermediate sluice is opened to allow the barges to pass through. When the falling tide brings the sea water level to that of the water in the basin, the intermediate sluice is closed and the sea-wall koker is opened, so that the barges can go out.

At each tide the koker is left open long enough to let as much water out as has come into the estate from the conservancy canal, since the koker was last opened, less that amount of water which has been lost by evaporation during its passage through the estate or has passed through to the fields by seepage and irrigation.

Weed control

Dragline excavators are constantly at work maintaining the main and

† Koker (Dutch): a water gate.



A sailing boat, bound for Georgetown, passing out of the lock basin to the open sea. This koker is made of hardwood boards and is raised or lowered in vertical grooves in the wooden pillars

sideline canals, for growth of mosses and aquatic weeds would impede the flow of water and block the progress of the punts. Trials with the freshwater fish, *Tilapia mossambica*, which has been used for weed control in some tropical countries, have not been successful in British Guiana.

Pentachlorophenol (PCP) herbicide spraying is useful in the drainage canals, but cannot be used on the main freshwater canals as this water is used for washing and drinking, and the fish, *hassa* and *houri*, a major item in the diet of the people, might be killed.

The weed problem at the Georgetown municipal water works has been solved by keeping two sea-cows‡ in the reservoir, and these eat a vast quantity of aquatic weed daily. Unfortunately this is not possible on the sugar estates as sea-cow beef is a delicacy which would be considered fair game by any villager.

Costly hand weeding is therefore still necessary, because effective water control is the fundamental requirement of agriculture in British Guiana.

‡ Sea cow or manatee: an herbivorous aquatic mammal about 10-12 ft. in length, with four limbs and a shovel-shaped tail—probably the origin of the legend of the mermaids, though a most ungainly creature.

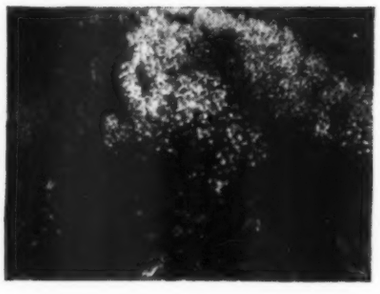
Above:

A Guianese fisherman throwing a casting net into one of the freshwater canals

Left:

Cleaning up a field drain after the cane has been cut

This Month's Cover Picture



Boron deficiency seriously affects the growth of all cruciferous crops. The commonest symptoms, which are most noticeable during years of low rainfall and on heavily limed or light soils, are poor seedling growth due to inadequate root development, cracking of stems in older plants and reduced flowering. Seed production is poor and their oil content is low. Internal decaying of stems in leafy species and of bulbs in swedes and turnips reduces keeping quality and market value. The application to the soil of a boronated fertiliser or foliar spraying with a soluble borate will correct deficiency and result in greatly improved growth and seed production.

BORAX CONSOLIDATED LIMITED,

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Advertisers Announcement

Control of Latex Coagulation

The amount of acid required for coagulation of latex is not a constant figure, but depends on various factors, such as the amount and type of anti-coagulant used in the field, nature of the clone, weather, quality of the water used, distance to the factory, dilution, time of coagulation etc., and may therefore vary from day to day. These factors make it difficult for the rubber maker to determine daily the optimum amount of acid required for coagulation. Experience may enable him to estimate the required amount, but sometimes this results in too much acid, giving a hard coagulum, which may cause difficulties in the milling of sheets, or in too little acid, resulting in a milky serum entailing a loss in rubber and a liability to bacterial action.

Both extremes, too much or too little acid, may influence the quality of the final product and reduce the outturn of first-grade rubber. A well-performed coagulation should give a clear or slightly opaque, yellowish-coloured serum. See Advisory Circular No. 67, recently issued by the Rubber Research Institute of Ceylon.

Flowers from the Tropics

J. S. CAMPBELL

There is a steadily growing trade in the export of cut flowers from the tropics to the colder, temperate regions. This survey of world production gives some idea of the importance of flowers as a world crop.

THE commercial production of flowers in tropical countries, either for home sale or export, though attempted on a small scale before the war, has expanded considerably in recent years. The factors mainly responsible have been the increase in tourist traffic, improving standards of living, the appeal of the rare and exotic and the introduction of more colour into offices and homes.

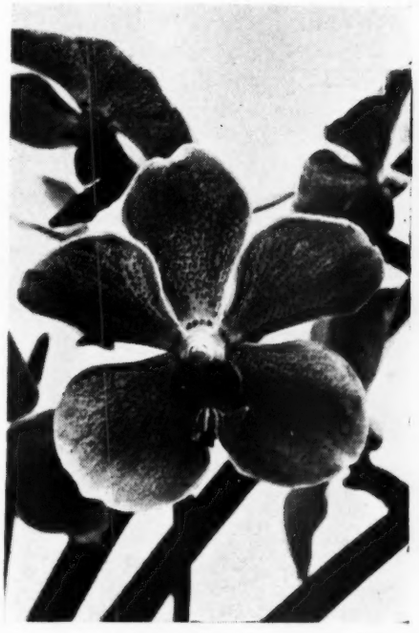
The increase in air travel, with regular operational schedules, was, however, mainly responsible for the development of the export trade in tropical flowers. They can be grown cheaply and under more favourable conditions in the tropics than in the hot-houses of the temperate regions and can be transported speedily and smoothly to far-distant markets, where there is a ready sale for such colourful blooms.

Whilst the choice of soil is an important factor in the successful cultivation of flowers in the tropics, it does not determine the geographical distribution of high-value flower crops. The climatic factors, particularly temperature, rainfall, humidity, and day-length are more fundamental. Soils can be improved by the addition of organic manures and fertilisers, but it is neither easy nor economic to alter the climate of an area by artificial means.

Highland and lowland production

It is apparent that in the tropics there are two rather ill-defined areas of commercial flower production, based on height above sea level; the lowland gardens at 0-1,000 ft. a.s.l. of Hawaii, Singapore, Hong Kong, Cuba and Trinidad, and the highland gardens at 3,000-5,000 ft. of Malaya, Kenya, Haiti, Costa Rica and Jamaica. The temperature conditions in these areas determines the type of flowers which can be grown, and their quality.

In the lowland gardens, where night temperatures are high, *i.e.* above 60°F, and where there is high rainfall and humidity, the truly tropical flowers, which are mainly perennials, can flourish. These include Vanda orchids, anthuriums, ixora, tuberose, heliconia, gingers, and birds of paradise, *Strelitzia sp.*, and foliage plants like croton, dracaena and ti, *Cordyline terminalis*.



Vanda hybrid 'Nellie Marley' produced in Hawaii

Floral display of tropical flowers by the Caribbean Flower Co., Port of Spain

It is also possible to grow, though with difficulty, roses, shasta daisies and temperate annuals, like asters and antirrhinums, at sea level. However, length of stem and size of flower is considerably improved when they are grown under lower temperatures. This can only be achieved with increase of altitude, say, 2,000-3,000 ft., or above.

On the other hand, certain flowers like delphiniums, anemones, carnations, agapanthus and calla lilies demand still lower temperatures and can only be produced in the highlands. In Kenya, primroses, daffodils and tulips are grown commercially above the 5,000-ft. level.

The effect of day-length on length of stem, size of flower or time of flowering in the case of annual and perennial flowers is probably much more important than is generally

appreciated. Plants particularly affected include the chrysanthemum, shasta daisy, aster, michaelmas daisy, and gardenia.

Centres of production

Being such a comparatively new and still small industry, it is difficult to obtain figures of production of cut flowers. This is not peculiar to the tropics, because it is only in comparatively recent years that such statistics have been available even in the U.K. By far the largest producer is Hawaii. The current annual value of this industry is estimated at U.S. $2\frac{1}{2}$ million of which U.S. $1\frac{1}{2}$ million is exported. All its exports of Vandas, anthuriums and foliage are flown to the 'Mainland' (U.S.A.).

In the Caribbean, the main producers are Cuba, Jamaica, Costa Rica, Haiti and Trinidad. The value of their exports was around U.S. $40,000 in 1957. About 20% was exported to the U.S.A. and the remainder was sold within the area, mainly to the rich oil-producing islands of Curacao and Aruba where, owing to lack of rainfall, no flowers can be grown.

In East Africa, Kenya and Uganda are the main producers for the local markets of Nairobi and Kampala. Similarly, flowers grown in the Cameron Highlands of Malaya are sent to Singapore. However, in the last few years a small export trade, by airmail, of Vanda, Arachnis and Aranda (Arachnis X Vanda) orchids has grown up between Singapore and the U.K.

The hardy orchid, Vanda joaquim, *with its ground roots in rotting coconut husks and supported on posts by its aerial roots*

Fluctuations in demand

Sales in the U.S.A., the leading world importer of flowers, vary considerably from month to month, and from year to year, the bulk of the flowers being sold between November and May. The main festivals fall during these months, together with the remembrance days—St. Valentine's Day and Mothers' Day—both important factors in the growth of this business. Shipments of tropical flowers into the U.S.A. coincide mainly with this period, and imports are much reduced during the rest of the year. Local flower sales in the tropics appear to follow a similar pattern but with many more festivals and other auspicious occasions.

Orchid growing in pots, and supported on slats of tree fern

Orchids

Although orchids comprise one of the largest of the plant families, only comparatively few are used in the commercial cut flower trade. In the tropics, by far the most important is the terete Vanda, var. 'Miss Joaquim'. This hybrid *Vanda* was raised in Singapore in 1893, taken to Hawaii about 1925, and became the backbone of the Hawaiian lei,* and local and export cut flower trade. During the past eight years its popularity has declined in the U.S.A. and more recent *Vanda* hybrids have not been able to recapture this market.

Whilst the *Cattleya* is still probably the most widely grown commercial orchid in the temperate countries, particularly on the North American continent, its cultivation in the tropics is limited. The demand for corsages, its main use, is small. Orchid preferences in the U.S.A. and U.K. have, however, been shifting away from the Cattleya toward the *Cymbidium* and other spray-type orchids. Unfortunately, this orchid flowers at night temperatures lower than those found in most parts of the low tropics. On the other hand, *Spathoglottis* grows well and their pink, purple, white and yellow flowers are popular as cut flowers. Both *Phalaenopsis* and *Dendrobium* are cultivated successfully and produce long-lasting flowers, of especial value in bouquets.

The tropical systems of cultivation of orchids are very different from the temperate methods, but there is no doubt, however, that, for optimum growth and production of flowers, regular manuring with organic and proprietary inorganic manures, and frequent watering, particularly during drier periods, is essential. For certain varieties a half shade is also essential.

Anthuriums

The anthurium, *Anthurium andraeanum*, is one of the best flowers to grow commercially in the low, wet tropics. They are at present cultivated in Hawaii and Trinidad on quite a large scale for local sale and for export to North America. Possessing a rather exotic and lurid appearance, their great advantage lies in their keeping-qualities—up to a month under temperate conditions and even a fortnight under hot, tropical conditions. Many colour variations have been and are being produced by hybridisation, varying from white to pink, orange and red. The main variety grown in Trinidad is the pink and in Hawaii it is the red.

The anthurium will flower all the year through, provided it has plenty of water, good drainage and about 50% shade. An average of five to six

* Lei: flowered garland—a ceremonial offering.

flowers can be expected within a year from a single plant. The rate of flowering is, however, dependent on variety, and breeding work is in progress in Hawaii to obtain higher-yielding selections.

Chrysanthemums

Chrysanthemums have been grown in many parts of the tropics on a small scale. In the Northern Hemisphere, *e.g.* at Hong Kong and in India, they come into flower at one season, *viz.* November-December. Judging by recent results in Hawaii, year-round production is possible. Furthermore, one of the considerable advantages of the chrysanthemum varieties grown, normally pompons, is their capacity to last at least a fortnight indoors.

Chrysanthemums are short - day plants needing a day-length of 14½ hours, or less, for flower buds to initiate, and 13½ hours, or less, for flower buds to develop. Within most parts of the tropics, therefore, even the longest days are shorter than the critical day length for flower-bud initiation. By extending the day length to above 14½ hours by artificial lighting, plants can be kept in a completely vegetative condition.

The number of long days to which the plants are exposed depends very largely on the length of stem required. Bud initiation will commence when the lights are removed, and the period of time, from when this is done to the date the plants flower, is of a definite length, though it will vary from variety to variety. It is therefore possible to bring chrysanthemums into flower when desired.

Gladioli

Gladiolus is both a popular garden and commercial flower in most parts of the tropics and can be grown, so long as the area is frost-free. Cultivation methods are essentially similar to those in the temperate countries, and the flowers, once cut, last in the house, in warm conditions, up to a week.

The planting material—or corms—is generally imported from Holland and the U.S.A. Corms may be replanted more than once, so long as they are dried off properly and given a period of cold storage during their resting stage. A cheaper and more rapid means of breaking the dormancy of corms has recently been developed in Hawaii, by the use of ethylene chlorhydrin.

Other flowers and ornamentals

Many cut flowers are grown principally for local sale. Some, such as shasta daisies, carnations, asters, antirrhinums and tuberoses, do enter the export trade in the Caribbean. Unlike the four major crops already discussed, which can be grown most of the year, many of these other crops tend to be seasonal and, furthermore, often do not last well once cut, *e.g.* roses, gerberas and dahlias.

Foliage has become a most important part of the cut flower trade and is used in all types of floral arrangements. Principal foliage plants, grown for export from the tropics, are ti or rayo, Dracaena, croton and anthurium leaves and both these and asparagus ferns, lycopodium, false sago, myrtle, amongst many others, are used in the local trade.

Home sale

For home sale, flowers are normally picked daily, in the morning or, preferably, the evening before. All flowers are bought on consignment or for immediate sale.

The consumer to date has not been aware of the difficulties of regular production throughout the year, and is not prepared to pay higher out-of-season prices, as is usual in temperate countries. Furthermore, large-size blooms appear to be in greater demand than quality.

Slatted orchid house with orchids, mostly Cattleyas, hanging above arthuriums planted in the ground

Gladioli growing in narrow beds without stakes

Export

The efficiency of the air-lines in handling this perishable freight, both in the air and on the ground, plays a very big part towards making the export trade possible. Although reasonable freight rates have been established, transport of flowers is still expensive and this, coupled with the value of the product, makes it imperative for the grower to make every effort to pick his flowers at the optimum period and only to send away a quality product.

The flowers are normally packed in light cardboard or fibre-board boxes, varying in size from 8 in. × 8 in. × 6 in. up to 4 ft. × 1½ ft. × 1 ft. No standard sizes have yet been adopted. Generally, orchids are placed in the smaller containers, whilst the heavier cut flowers and foliage are packed in the larger boxes. Commercial shipments may consist of several hundred ti leaves or ten to fifteen dozen anthuriums in each container.

Seasonal requirements and price fluctuations have been two of the major difficulties, and the volume of business has not, as yet, warranted advertising to improve sales. Again,

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Photo: Tea Bureau, London

Unshaded high-altitude tea in India

Shade for Tea

C. R. HARLER, PH.D.

AS long ago as 1875, the value of *Albizia chinensis*, formerly *A. stipulata*—the sau tree—was fully recognised as a shade tree in Upper Assam. In 1884 the Indian Tea Association published a pamphlet on shade trees in tea. In 1900, the *Grevillea robusta* was being used as a shade tree in Ceylon tea estates, yet neither this tree, nor any other non-leguminous tree, including the rubber, *Ficus elastica*, the simul, *Bombax malabaricum*, the nahor, *Mesua ferrea*, and the tung, *Aleurites montana*, gave worthwhile crop increases in the tea estates of North-East India.

In 1902 it was recorded that Assam-type tea bushes under leguminous shade, planted 40–60 ft. apart, gave about double the yield of those growing in full sunlight. It was also observed that shade increased the liability of the tea to blister blight, *Exobasidium vexans*, but reduced red spider attack.

Not till 1936 were replicated shade plots put out at the Tocklai Experimental Station, Assam, India, and then it was seen that the optimum shade spacing was one which reduced the natural sunlight intensity by about 50%. This condition was achieved by sau trees, planted 50 ft. by 50 ft. triangular.

The combined effects of shade and fertilisers on tea were also studied and the results of such observations were of great value. In Assam 10-year-old tea, unshaded and unfertilised from the time of planting, yields about 560 lb. tea per acre. Similar tea grown under optimum shade conditions gives about 1,200 lb. per acre, a gain of 640 lb. Unshaded tea, receiving sulphate of ammonia at the rate of 80 lb. nitrogen per acre, also yields 1,200 lb. tea per acre. Thus the shade effect is the same as the increase given by a normal dose of fertiliser. However, shade and fertiliser together do not each give an increase of 640 lb., but only 960 lb. between them, making a total yield of 1,520 lb. Thus the shade reduces the sulphate of ammonia effect by half, or vice versa.

It has also been shown in Assam that the response of the tea bush to shade depends on the variety of the bush. Of the types planted commercially, the Assam responds best, whilst the China gives very little increase. The big-leaved tea varieties are considered to be shade demanders.

The best shade

After trials with many species of leguminous shade trees it has been concluded that the best suited to conditions in North-East India are the *Albizia odoratissima* and two types, green and yellow stipuled, of sau, *A. chinensis*.

In recent years the effect of shade *per se* has been studied in Assam. It has been shown that the shade given by bamboo slats, spaced to reduce the

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Photo: Tea Bureau, London

Heavily shaded tea at Balijan, Assam, India

Unshaded high-altitude coffee, C. arabica, *in Kenya*

Shade for Coffee

A. E. HAARER, F.L.S.

IN the past, shading of coffee has been practised by the British, French and Dutch planters. Trees were selected, which would provide a light shade, and they could either be lopped or allowed to grow, in order to reduce, or increase, the amount of shade, as required. It has been known for many years that shade has a depressing action on flowering and cropping, but the practice was adopted to help maintain the health of the coffee, by preventing over-bearing and shielding the crop from too much strong sunshine.

Photo: FAO

Lightly shaded coffee with Cordia holstii *in Yemen*

Coffee is, of course, not like tea. In one case, it is flowers and fruit which are required, and in the other it is leaf. Too much shade can depress coffee yields, though in many coffee regions shade acts as a crop regulator. Shade encourages leafage, hence its value for tea; but adequate leafage is also required for coffee.

To keep the shade nicely regulated at all times was not easy; to choose the right kind of shade tree to harmonise with coffee and to suit the soil conditions of a particular locality was another problem; and to prevent the shade tree from competing with the coffee for moisture where droughts were liable to occur, was impossible.

The controversy over the question whether coffee does, or does not, require shade, which seemed to have been settled, has been renewed, following the introduction of a more drastic system of pruning the crop. The view is now held in certain quarters, that, if shade is cut out and heavy manuring adopted, the coffee will bear heavier crops, which can at any time be reduced by a more drastic method of pruning.

It was formerly laid down that shade was necessary below 5,000 ft. a.s.l., but generally not at higher altitudes. The exception was where the temperatures were too low and the cold Kabatic winds were liable to damage young growths. Then it was considered shade was necessary to shelter the plants.

Advice of this sort is all rather arbitrary, as so much depends on the aspect and the position—whether the slope faces the morning or the afternoon sun; whether the site is sheltered already, receives the warm trade winds, or the converse. Thus it is not too satisfactory even for conditions in Kenya; it is still less so for other coffee-growing regions, where they are materially different.

In Kenya, where there is very little, if any, low-altitude coffee, the rainfall is lower and falls in two seasons; the minimum temperatures are generally satisfactory, but the maximum temperatures in the best coffee areas tend to be rather too high for more than half of the year in spite of the altitude. Naturally, the humidity also fluctuates according to the prevailing conditions.

In many of the other coffee-growing regions, a heavier rainfall is normal

Shaded coffee in Java under Leucana glauca

and sometimes it is markedly seasonal, being concentrated in a single wet season. This is sometimes accompanied by temperatures on the high side.

Where shade trees are grown with coffee, opinion in East Africa now tends to favour *Albizia chinensis*, formerly known as *stipulata*, and *Cordia holstii*. This variety makes a fairly quick growth and eventually gives a good spreading shade; the wood is not brittle, but is easily pruned; and its life is longer than some of the quicker-growing Albizias. Elsewhere, a special strain of *Leucaena glauca* is favoured.

Coffee does not appear to require shade in Brazil, but there the minimum temperatures are quite low, and the crop sometimes suffers severely through frost. The weather is dry at harvest time, but before this, when the crop is being carried, there is rain and cloud, and the trees develop luxuriant foliage, so no additional shade is necessary.

In Tanganyika, too, coffee is grown at 5,500 ft. on Mt. Kilimanjaro without shade. Growth is healthy and the trees produce good crops—without exhaustion and without apparent disease. There it is quite cool, even in the sun, and the rainfall ranges from 75 in. to over 100 in. The trees generally do not produce too much growth, nor do they over-bear, as they would with a similar rainfall elsewhere.

What is to be done in those areas where it is necessary to prevent overbearing? Provide shade or adopt the new method of drastic pruning to reduce the crop? Obviously, it is for the individual planter to decide how he is going to regulate matters. In making his decision, there is one point that he must not overlook—what would happen to his unshaded coffee if prices fell so catastrophically low that mulching, weeding and pruning had to be suspended?

This would ruin unshaded coffee beyond redemption, whereas a property with shade trees, which has been neglected for a long period of time can be brought back into economic production, when prices again recover. This happened with the ex-enemy estates on the lower slopes of Mt. Kilimanjaro, which were completely neglected from 1916 until 1921-22. When their new owners took over they lopped the shade trees, pruned the coffee trees, cleaned up the plantations and soon they were back in production again.

Shade for Tea

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light to 70% and 50% of full sunlight, both increased the yield by 34%.

The effect of shade on the constitution of the leaf is also being worked out, and for this purpose four clones are used, a glabrous and a pubescent Assam form, an Assam/China cross and a China dwarf form. These are being grown in light intensities ranging from full sunlight to 50%, 35% and 20%. Under these various conditions leaf and root weight, leaf area, net assimilation rate, composition of the shoot, phloem index, the effect of fertilisers and other factors are being followed. The results of these observations will no doubt throw light on a complex problem, but the basic facts relating to the value of leguminous shade grown with the Assam types will remain.

In Africa the use of shade trees in tea is not yet appreciated, although with the Assam type of bush grown there, shade is very desirable. Any experiment which serves to bring this fact before the planter is of value.

Flowers from the Tropics

(*Continued from page* 461)

the producers themselves, mostly small growers, tend to compete against each other for markets. To help overcome these problems, the formation of a co-operative marketing system or a trade association has been suggested in Hawaii, and this idea might be followed elsewhere.

Conclusion

Since the last war there has been a remarkable shift in the production of flowers from the northern states of the U.S.A. to Florida and California. So long as areas are carefully chosen, and given regular air schedules and cheap freight rates, there seems to be no reason why the tropics should not now play a greater part in the production of flowers for temperate markets.

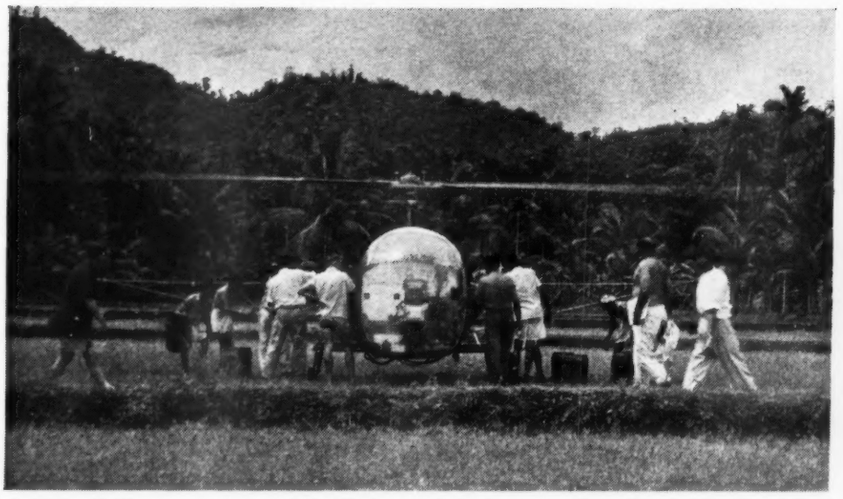
As a corollary, the current practice of producing flower seed in East Africa and Costa Rica, gladiolus bulbs in Jamaica, lily bulbs in St. Helena and Bermuda, orchid plants in Singapore, Panama and Hawaii might be extended to other flowers and other regions.

Aerial Spraying of Rubber

P. DE JONG*

ONE of the greatest problems in the cultivation of rubber in Southern India is the fungus *Phytophthora palmivora*, which produces a secondary leaf-fall of rubber. Of the 225,000 acres of rubber, mostly in Kerala State, more than 90% is affected by the disease to a greater or lesser degree, depending on local variations in climate and topography. Uncontrolled, this disease can cause reductions in the yield of latex of the order of 50% in a season, and repeated infections have a marked effect both on yield and the capital value of the trees.

In a country far from self-sufficient in natural rubber, losses of this order are a serious matter, particularly as much of the existing area is still planted with low-yielding, old, seedling rubber; the problem becomes even more important when the question of large-scale replanting with high-yielding clonal material is under consideration and when strenuous efforts are being made to increase the production of natural rubber in India.



Refilling helicopter spray tanks with fungicide during operation (the rubber area being sprayed can be seen in the background)

High-volume spraying

The fungus makes its appearance about May, in the humid weather immediately preceeding the outbreak of the south-west monsoon, and becomes fully established, with devastating results, by June or July. In the past the traditional method of control has been the application of massive quantities of Bordeaux mixture, at rates varying from 400 to 600 or more gal. per acre, depending on the density of the stand of rubber.

The method of application has been to use manual or power-operated sprayers supplying the spray mixture to lances, fitted with coarse nozzles. These are carried up into the canopy by labour skilled in climbing the trees. It can readily be appreciated, however, that this technique is extremely time- and labour-consuming, since up to 120 trees have to be climbed in each acre.

In recent years, increases in cost of materials and, of even greater importance, increases in labour rates and the overhead cost of amenities such as housing, education, hospitalisation and other benefits, have materially increased the direct and indirect costs of Bordeaux mixture spraying. It is also becoming progressively more difficult to persuade labour to climb the trees and carry out effective spraying, with the result that the protection afforded is becoming steadily less effective.

These factors have, during the last few years, caused the rubber industry in Southern India to look for alternate methods of fungicide application to rubber, which will reduce the labour requirement and speed up the process, enabling larger areas to be treated in the short interval between the full refoliation of the trees after the period of natural wintering and the onset of climatic conditions favourable for disease establishment.

Dusts and low-volume sprays

Copper dusts applied by power dusters have been tried, but except in certain limited areas, where the incidence of the disease is normally slight and where the rainfall is not so heavy and prolonged as to wash the dust from the leaf, this technique has not proved generally satisfactory.

In recent years, oil-based copper fungicides, applied either in an emulsifiable form or further diluted with oil, have been tried, using low-volume air - blast sprayers for the application at rates of 3 or 4 gal. per acre, and promising results have been achieved.

A major difficulty, however, is the development of a low-volume sprayer sufficiently light to be easily portable over the uneven ground on which much of the rubber is planted and sufficiently powerful to project the fungicide to the upper layers of the leaf canopy, which, in much of old seedling rubber in Southern India, may be over 100 ft. above ground level.

Aerial spraying

This year, *Tata-Fison (Pte.) Ltd.*, in co-operation with the Rubber Board and some of the leading planting companies in Southern India, have carried out a preliminary investigation of the possibility of applying oil-based copper fungicides at low-volume rates, using a spray equipment fitted to a helicopter. The trial was carried out at the Kinalur Estate of the Cochin Malabar Estates Ltd., near Calicut in Kerala, and can be considered to have satisfactorily answered the major questions.

Using a Bell 47 D.1, operated by *Autair (Helicopters) Ltd.*, and fitted with an *Ostermans* Aero AB spray gear, over 152 acres of old seedling rubber

*Technical Manager, Tata-Fison Pte., Limited.

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Mr. Warrier, Chairman of the Rubber Board, and others watching the helicopter being refuelled in a nearby paddy field

were treated in a total time of 125 minutes. During this period the helicopter was actually flying for 105 minutes and it made two stops for refuelling with oil and petrol. No special landing ground was prepared, as the helicopter was able to operate from an area of fallow paddy land, adjoining the rubber.

High-speed operations

A specially formulated, oil-based copper fungicide was sprayed at the rate of 3 lb. of metallic copper per acre in 4 gal. of *Stanvac* 'Sovaspray' oil, and the application was carried out in 21 sorties, the helicopter lifting 30 gal. of formulation and spraying some 7½ acres of rubber on each occasion. The helicopter came in 20 times for refilling with fungicide and the time taken for this operation was never more than 45 seconds. Estate labour was used for the mixing of the formulation and, after the second sortie, for assistance in refilling.

The area sprayed was a long strip of rubber on the south-western slope of a low ridge and was not particularly easy to fly over, the ground itself being uneven and crossed by ridges and the canopy of the old seedling rubber being very irregular. Examination of leaf samples taken from this area during and after spraying showed that penetration of the fungicide had taken place throughout the depth of the leaf canopy.

Site marking

One of the main problems to be solved was the marking of the spraying site and placing the markers on which the pilot could line up. Flags or drogues, tied to bamboo poles and lashed to the rubber trees so that they projected about 6 ft. above the canopy, and gas-filled balloons proved practical and it was found that, if the boundaries could be demarcated satisfactorily, then the pilot could probably select natural land-marks within the area to guide him on his sorties, thereby eliminating the need for mobile ground markers. The value of preliminary flight familiarisation was well established during the trial.

Promising technique

Any assessment of the protective efficiency of the spray application cannot be made until later in the season when disease incidence has developed, but this trial has demonstrated convincingly that helicopters can be used for making spray applications of fungicides to rubber and, under normal conditions of operation, rates of application of no less than 70 acres per hour can be achieved. It has also shown that an apparently satisfactory leaf coverage can be obtained with application rates of the order of 3 or 4 gal. of concentrate spray per acre.

The technique would appear to have promise in the control of secondary leaf-fall caused either by the fungii of *Phytophthora* spp. or *Oidium* spp., both of which are major factors in the growth of rubber in India and Ceylon.

Agricultural Training for Women

Studley College was founded in 1898 by Frances Evelyn, Countess of Warwick, the object being to provide an education in agriculture and horticulture for the young women of her day. Today it is still the only college solely for women in England.

Studley College offers to the intending student the choice of two main courses which she can follow during her two years of training. There is a diploma course in dairy farming and another in horticulture, where the student is trained in commercial and ornamental horticulture and floristry.

A third course is due to start in September 1961. This will be for students who wish to study the business side. This course will make them familiar with farm records, accounts and general commercial subjects including shorthand and typing, economics, accountancy and bookkeeping, as applied to agriculture and horticulture.

The college estate covers 340 acres; the farm, which is run on commercial lines, is some 240 acres in extent, and the horticultural side has 25 acres of commercial glass-houses, orchards and market gardens, and also the extensive ornamental gardens of Studley Castle.

The castle, built in 1833, has accommodation for 90 re ident students who are accommodated in single study-bedrooms and in shared rooms.

Students from overseas can be received but further particulars should be obtained from Miss E. E. Hess, the Principal.

World Ploughing Championship, 1960

The World Ploughing Championship this year was won by John Gwilliam, of Herefordshire, England, using an *International Harvester* tractor and a *Ransomes* plough.

Ploughmen from 16 countries competed in the Tiber valley, 15 miles from Rome. Second place was taken by Arne Braut from Norway, followed by Henry Jones from Swansea, Wales. The fourth and fifth places were taken by Canadians.

Leaf Mining Beetles of the Coconut

R. J. A. W. LEVER*

THROUGHOUT that large portion of the tropics extending from Indo-Malaysia in the west through the Philippines, New Guinea, Melanesia and western Polynesia, the fronds of coconut and a few other palms are liable to severe injury from small beetles belonging to the family Hispidae. These small, flat insects, often brightly coloured, are about ⅓ in. long. They spend their time in the crowns of the palms, taking about five weeks to complete their life-cycle.

Damage done

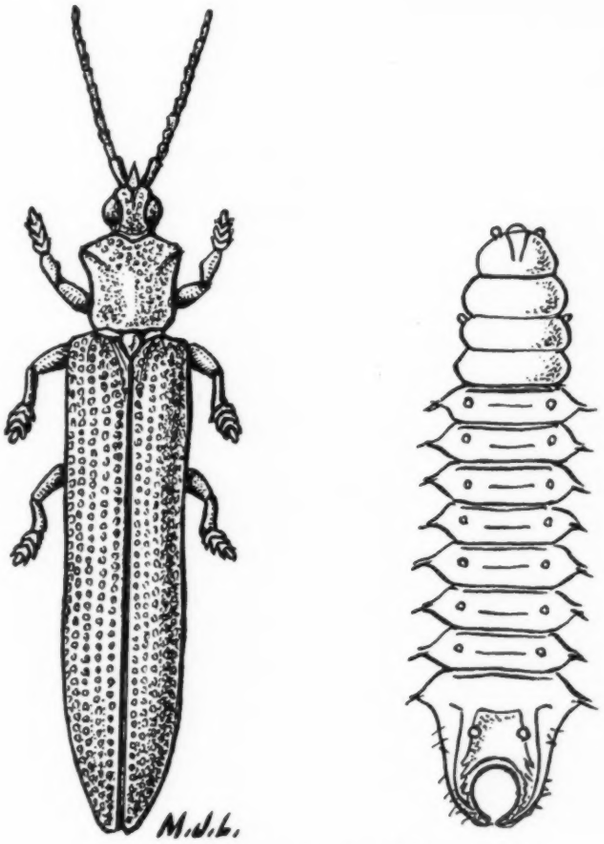
Two distinct types of injury may occur. These are described as interpinnal and intrapinnal, depending on whether the larvae are found between or within the fronds. In the first group, the grubs or larvae feed between the 'heart' leaves of the unopened spathes in the centre of the crown, causing extensive brown patches. Later the adult beetles will gnaw a series of fine parallel grooves in the expanded fronds.

The best-known example of this type of pest is the genus *Brontispa* found in Java and other Indonesian islands, in New Guinea and in the Solomons. A serious setback can be caused, especially in drier areas or during dry spells, to young four- or five-year-old palms through having photosynthesis checked by the damage done by the young and the adult beetles.

In the second type of injury, the larvae, soon after hatching from the egg, penetrate between the upper and lower epidermis of the leaflets and feed on the spongy tissue. This results in a long brown scar up to 6 in. long. The narrow grooves produced by the beetles cause the fronds to assume a tattered grey, scorched appearance and they are unable to function as leaves. The genus *Promecotheca*, found as different species in the Philippines, Bismarck Archipelago, New Hebrides, Fiji and Samoa, is a good example of this intrapinnal type of pest.

Photo: R. A. Lever

Frilled fronds of coconut palms on Singapore island, caused by the leaf-eating beetle Promecotheca cumingi



Adult Larva *Brontispa longissima* × 11

Chemical control

In the early plantation days in the Pacific islands, severe losses were caused to the young palms and many died, for, with the poor selection of insecticides then available, all that could be done was to pour a mixture of tobacco juice and soap solution into the crowns of the palms. This method was still being followed in the early 'thirties, when lead arsenate was also sometimes used.

With the wide choice of chlorinated hydrocarbons now available, excellent

*Formerly Entomologist, Department of Agriculture, Malaya.

results have been obtained with dieldrin at 0.15%, DDT (0.2%) and chlordane (0.16%). Only those who have had to rely on the more primitive insecticides can fully appreciate how much the planter's work has been eased by the use of modern agricultural chemicals. The figure of £65,000 over 10 years has been mentioned as the cost of insecticides and labour expended by one large company in the Solomons in the pre-war years.

Biological control

Biologists have also played their part in the control of these leaf-beetles. After leaving the Pacific, the writer accompanied a team of American entomologists who were making a collection in Malaya of parasites from allied beetles. Two species of minute Hymenopterous egg and larval parasites from Selangor were sent by air, together with some material from Java, to Saipan and Rota in the Marianas. One of these parasites, *Tetrastichodes brontispae*, has virtually brought under complete control the indigenous leaf beetle in these islands near Guam.

How efficient these parasites can be in finding and parasitising the larvae within the mines of coconut fronds was shown in Singapore in 1951. The writer found that a Philippine species of the pest, *Promecotheca cumingi*, had become established in one part of that island. Large numbers of a larval parasite, *Pleurotropis parvulus*, were reared, although this was an insect which had not previously been recorded from Singapore or the Malayan mainland.

The typical frilling of the tips of the fronds soon disappeared as the pest was brought under control by the parasite. As the bulk of the palms were about 40-50 ft. in height, it would have been extremely difficult to reach them efficiently, even with power sprayers, especially as this was a heavily populated area.

Coming Events

Seed Improvement.—A Crop Conference on the subject of 'Better Seeds —Better Crops' will be held at the National Institute of Agricultural Botany, Huntingdon Road, Cambridge, on Tuesday, 13 December. Particulars from the Secretary of the Institute.

Potato Quality.—A Crop Conference will be held on this subject on 14 December at the National Institute of Agricultural Botany.

Weed Control.—The North Central Weed Control Conference will hold its annual meeting in Milwaukee, Wisconsin, U.S.A., from 12-14 Dec.

Corrosion and Metal Finishing.—The 1960 Exhibition will take place at Olympia, London, from Tuesday, 29 November, to Friday, 2 December.

Full information is available from the Organiser, *Corrosion Technology*, Leonard Hill House, Eden Street, London, N.W.1.

Agronomy.—The American Society of Agronomy, the Crop Science Society of America and the Soil Science Society of America will hold their annual meeting in Chicago, Illinois, U.S.A., from 5-9 December. Enquiries should be sent to the American Society of Agronomy, 2702 Monroe Street, Maidson 5, Wisconsin, U.S.A.

Hybrid Maize.—The Hybrid Maize Industry Research Conference will be held in Chicago, Illinois, on 7 and 8 December.

Refrigeration and Air-Conditioning.—The International Refrigeration and Air-Conditioning Exhibition is to be held at Earls Court, London, from 11-14 April, 1961. Details may be obtained from Patrick Smyth, 1 Crane Court, Fleet Street, London, E.C.4.

Agricultural Exhibitions

England.—The Smithfield Show and Agricultural Machinery Exhibition will be held at Earls Court, London, from 5-9 December. Particulars may be obtained from Smithfield Show Joint Committee, Forbes House, Halkin Street, London, S.W.1.

Canada.—The Canada Farm and Industrial Equipment Trade Show will be held in Toronto from 25-28 January, 1961. Information from the Exhibition Organisers, 40 Wellesley Street E., Toronto 5.

The Ninth Salon of Agriculture will be held during February at the Palais du Commerce, Berri Street, Montreal. Enquiries should be addressed to the National Salon of Agriculture, 10819 St. Denis Street, Montreal.

Germany. — The annual 'Green Week' International Agricultural Exhibition will be held from 27 January-5 February. Enquiries should be addressed to Berliner Ausstellungen Eigenbetrieb von Berlin, Berlin Charlottenburg 9, Masurenallee 5-15.

Belgium.—The 41st International Agriculture and Agricultural Machinery Exhibition will be held in Brussels from 12-19 February. Details from Salon de l'Agriculture, 29 rue de Spa, Brussels.

Egypt.—The World Agricultural Exhibition to be held in Cairo will now take place from 21 March-20 April and not from 15 February-30 March, as previously announced. Details from the Exhibition Committee, Central Ministry of Agriculture, Cairo.

France.—The International Agricultural Machinery Exhibition will be held in Paris from 7-12 March. Particulars from the Salon International de la Machine Agricole, 95 rue Saint-Lazare, Paris 9e.

Italy.—The International Agricultural and Animal Farming Fair will be held in Verona from 12-20 March. Further details may be obtained from Secretary-General, International Agricultural Fair, Palazzo del Pallone, Verona.

South Africa.—The Rand Easter Show will be held from 21 March-3 April. Enquiries should be sent to the Witwatersrand Agricultural Society, P.O. Box 4344, Johannesburg.

S. Rhodesia.—A Central African Trade Fair and Exhibition will be held in Bulawayo from 3-14 May. Details from the Development Officer, Bulawayo Agricultural Society, P.O. Box 1776, Bulawayo.

A model Kamba smallholding at Makueni in the Machakos district. Typical of the modern methods of agriculture now being practised by Africans

Progress in Kenya

A. E. HAARER F.L.S.

A BOOK by Elspeth Huxley is always worth reading, and the account of what is happening in the tribal areas of Kenya in her book 'A New Earth—an Experiment in Colonialism'* should be read by everyone interested in the future of East Africa.

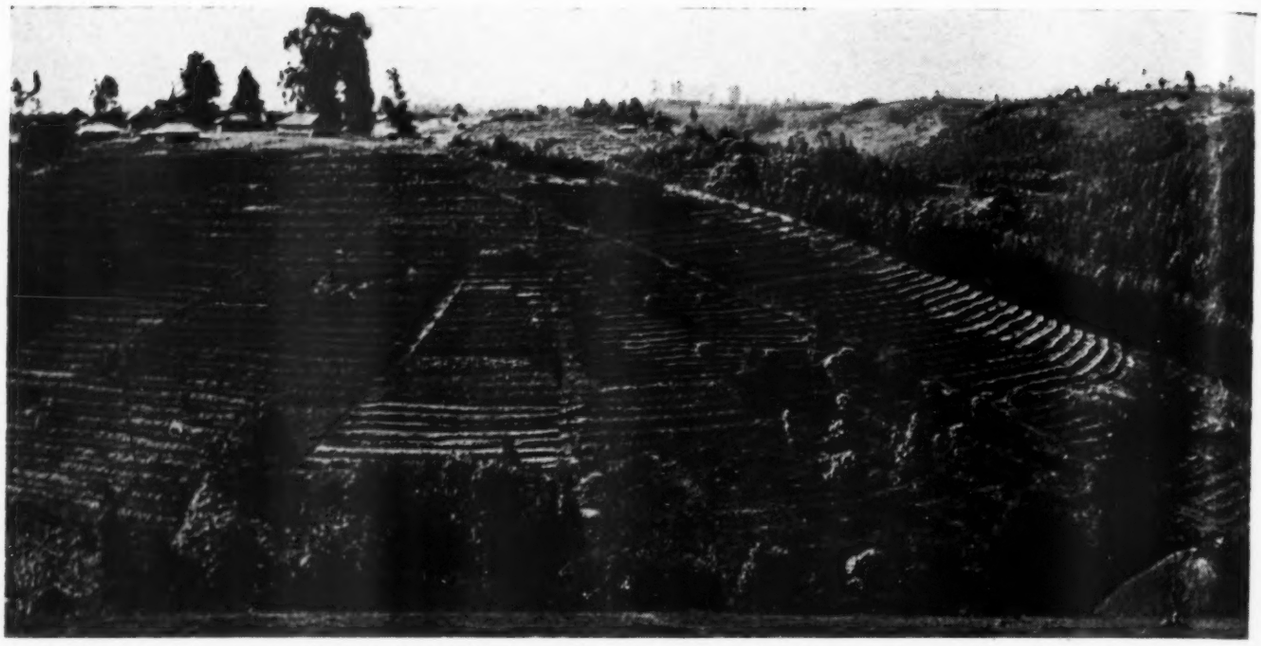
The author does not deal with politics, nor with Europeans; she takes the reader on a tour through the tribal areas, where, until a decade or two ago, the people were pastoral, unguided, and impoverished. Their grazing lands were so badly eroded that their stock was in poor condition; only in a few regions had progress started before the disastrous Mau-Mau troubles began.

During the regime of Sir Evelyn Baring quite a different state of affairs came into being. Extension officers had persuaded some of the more intelligent towards better farming, and had proved in a startlingly short period how the eroded land might be recovered, and how the people could become prosperous and comparatively rich.

These ideas have caught on until all have been eager to follow schemes for erosion prevention, bench terracing, fencing, improvement of grazing and mixed farming; all but the African politicians who have been antagonistic and endeavoured to sow suspicion. In fact a marvellous change is recorded,

Bench terraces and mulched coffee on a consolidated holding at Ngaru in the Fort Hall district. This farm is supervised entirely by the woman in the picture whose husband is a schoolmaster

* Chatto & Windus, London, 1960. Pp. 288. Illus. Price 30s.



In the foreground is an example of land consolidation with terracing for soil and water conservation. In the background are examples of fragmented holdings where lack of terracing allows flood waters to sweep down the hillsides with the loss of valuable topsoil

helped by loans of thousands of pounds to the separate tribes.

Depending on freedom from political strife and continuity of help, a period of prosperity is beginning, still quite often poised on a knife-edge of doubt, as to whether world prices will keep steady, or the people keep faithful to the teaching.

Land consolidation

Nothing a native does is against his will. He does not refuse a piped water supply, nor better live-stock. The women have found it better to exchange small fragments of land for one large plot, and it is extraordinary what has been done in so short a time. Yet there is much de-stocking and other work to be done which may take 10 more years to accomplish.

The author speaks of how these schemes may be doomed if inheritance divides the land again among a father's sons; of how tribal barriers and jealousies still exist; of how forest reserves are still destroyed in defiance of the law, because, if the people were angered, '*and a fracas were to arise, denunciation of colonialist oppression and tyranny would thunder from the benches of the House of Commons and repercuss all through the Secretariat*'.

There are insufficient industries outside farming to provide work for the surplus sons of farmers, and, since the better farmers appear to have from two to five wives each, they breed apace. The customs of the people are at war with the land. With many difficulties overcome, it would be terrible if others looming ahead were to spell doom to peoples who can be so lovable and who are still so helpless.

The author has endeavoured to insert botanical names. They are not always correct or consistent. It is her only fault.

Soil conservation being done mechanically in the Macharkos district. Conservation by bench terracing using communal labour has improved the land out of all recognition in recent years

NOTE FOR CONTRIBUTORS AND AUTHORS

The editor welcomes authoritative articles and news items on agricultural machinery and agricultural methods, agricultural crops and new developments.

It should bear the name and address of the author and be accompanied by sharp photographs or line drawings with suitable captions.

New Publications

Rubber in Malaya

Malayan Rubber Statistics. Department of Statistics, Federation of Malaya. 1959. Price M.$2 or 5s.

This comprehensive publication consists entirely of statistical tables and graphs. It covers acreage, production, yields, imports and exports, stocks, prices, rubber dealers, labour forces and world rubber statistics.

The total area planted to rubber in Malaya at the end of 1958 was nearly 3½ million acres, of which smallholdings (areas under 100 acres) were estimated at 1½ million acres. Of the estate area, just under half a million acres has not yet reached tappable age. Data are included giving details of the size groups of estates and of the area, now planted with high-yielding material—643,000 acres in bearing and 401,000 acres immature.

Production of Malayan rubber in 1958 was 662,872 tons. In other countries, production (in thousand tons) was as follows: Indonesia 667.5, Thailand 137.5, Indo-China 103.5, Ceylon 100, Sarawak 39, rest of the East 62.5, rest of the world 182, giving a total world production of 1,955,000 tons, an increase of 52,500 tons over 1957.

The overall yield of rubber per acre in Malaya was 586 lb., as compared with 510 lb. in 1950. The high-yielding material gave a yield of 854 lb. per acre, compared with 404 lb. per acre for unselected, seedling trees. From the above figures, it is evident that rubber production in Malaya will increase steadily for some years to come.

Interesting comparisons are given of estimated world production, consumption and stocks of natural rubber compared with various types of synthetic rubber and of reclaimed rubber.

The latest information (July 1957) places the labour force employed on estates (excluding smallholdings) at 276,700 persons. The average monthly earnings of a tapper was M.$81 per month, with foremen and factory workers earning more than this and weeders somewhat less. Normal working hours vary between 6½ and 8 per day. Amenities for the labour force appear to be good: 91% were eligible for free medical attention and all women workers for maternity allowance, while 85% of the total labour force were eligible for sick leave. Free accommodation was provided for 79%. As regards education, 25% of all estates provided education on estates and 7% helped to provide it elsewhere.

It is probable that no other country publishes such comprehensive statistics of a major industry than does Malaya in relation to her rubber industry. This statistical review is a business-like production intended for those interested in the rubber industry.

D. H. GRIST

Technical Books

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as retail booksellers will be pleased to supply any books reviewed in this periodical, and will give immediate attention to any requirements you may have for other works

(Trade not supplied)

Withering of Tea Leaf

Elementary Notes on Tea Manufacture by R. Child. Tea Research Institute of East Africa, March 1960, pamphlet No. 18. Pp. 16. Illus.

This pamphlet deals with the course of withering as related to time, and the temperature and humidity of the air.

Thus, during an 18-hour wither, over 70% of the drying takes place in the first nine hours. During the second nine hours the moisture moves within the shoot, from the bud and the stalk to the leaves, and the wither in the whole shoot evens up.

The leaf itself should not be allowed to attain a temperature above about 90°F, although in the early phases of withering slightly higher air temperatures may be employed in controlled systems. As the wither proceeds the leaf becomes sensitive to movement, whereby the semi-permeable membrane within the leaf cell is distorted and fermentation starts.

This change may begin in fresh, undisturbed leaf if temperatures are high enough. Plucked leaf tightly packed in a basket may well attain a temperature of 120°F and every planter is only too familiar with 'red leaf' brought in by pluckers.

Withered leaf should give a pale yellowish solution, when boiled with water, similar to that given by fresh leaf. If the colour of the former is reddish, then incipient fermentation has taken place and the liquoring qualities of the resultant teas are impaired.

As early as 1830 Jacobson in Java invented a withering machine, consisting of a long hexagonal box which was filled with leaf and rotated whilst hot air was pumped into the box. Bosscha, also in Java, used a similar box, called a limping machine, to finish off unwithered leaf in an hour at 92°F. Davidsons (Sirocco Engineering) patented a withering drum before 1900, and in 1927 Marshalls (Britannia Works, Gainsborough) produced a withering machine resembling a tea drier. All these failed because they did not obey the laws governing tea leaf withering.

Of recent years withering drums and tunnels have again been tried and success has been claimed. It has even been stated that machines using temperatures of 135°F and turning out leaf of appearance 'nothing short of appalling' have produced reasonably good teas. Such claims are false. The fact is that any experiment, made with care, may produce a better tea than that turned out by the normal slapdash procedure followed in some factories, but it is incorrect to draw general deductions from such.

The only satisfactory artificial withering system employed in factories to date is the controlled loft, or its logical extension, the mobile tat. A recent innovation with possibilities is the trough withering system, whereby leaf is spread 6-8 in. thick on hessian overlying weldmesh. Air is blown in from below, first to dry off, then to

wither, then to keep the leaf cool till rolling time.

The valuable pamphlet under discussion is illustrated and gives two pictures of the trough system. It should be read and studied by everyone interested in tea manufacture.

C. R. HARLER

Fruits for the Tropics

Some Fruits and Nuts for the Tropics by W. C. Kennard and H. F. Winters. Pp. 135. Misc. Pub. No. 801, Agric. Res. Service, U.S. Department of Agriculture, 1960. Price $0.50.

This beautifully produced and inexpensive publication deals with the edible fruits and nuts of tropical and sub-tropical plants, collected from many parts of the world and planted at the Federal Experiment Station at Mayaguez, Puerto Rico. It also includes fruits and nuts native to, or naturalised in, Puerto Rico. However, it does not include citrus, olives, bananas etc., as they can be considered major tropical fruits.

The bulk of the work—apart from some brief observations on climatic and soil variations in the tropics, propagation, culture and nomenclature—consists of notes on over 90 fruit and nut species. The information given for each species is: distribution, description of the plant, information on fruit (or nut) size, flavour etc., and propagation. Photographs of leaves and fruits or nuts are also included.

A list of 80 references is given, together with an index of plants by botanical and common English and Spanish names.

W. LINNARD

Horticultural Pests

By G. Fox Wilson, revised by P. Becker. Pp. 240. Illus. Crosby, Lockwood & Son Ltd., London, 1960. Third edition. Price 25*s*.

The first edition of this book was published in 1947 at the same time as a number of the new agricultural chemicals, including the now familiar DDT and BHC, were introduced. Since then many more have been discovered and it is important, therefore, that the text should be revised from time to time and brought up to date. The formidable task of preparing a third edition has been ably tackled by Dr. P. Becker, Entomologist to the Royal Horticultural Society at Wisley, where the late G. Fox Wilson carried out his original studies.

The book is concerned solely with the detection and recognition of the many symptoms of pest damage and with methods of controlling the pest responsible. The format of the earlier editions, whereby the different types of leaf discoloration, root damage, stem injury, flower seed destruction etc. are used as chapter and section headings, makes it a book of easy reference for scientists and laymen alike; the omission of entomological descriptions of the individual pests is a great advantage in reducing the book to a reasonable size and making it a most useful manual of applied entomology, which can be strongly recommended to all our readers. The illustrations and line drawings are indeed superb.

F. C. COOKE

Overseas Survey 1960

Published by Barclays Bank D.C.O., Lombard Street, London, E.C.3. Pp. 227. Illus.

This book covers the trade and economic conditions prevailing during the year 1959 in those overseas territories in which the Barclay group of banks is represented. This includes most of the African countries, the Caribbean islands, Canada, U.S.A., France, Algeria, Israel, Cyprus and Malta. The agricultural activities of each country are succinctly stated, together with new and projected developments. In addition, social and political developments are recorded, and information included on all important industries in each region. It is a most useful book of reference, is well produced and contains excellent illustrations.

Water Conservation Bibliography

The first comprehensive bibliography of references to literature on the subject of water conservation has just been published. Believed to be the first of its kind published anywhere in the world, it has been produced to assist research workers in this field; it lists 682 references, the work of 564 authors and authorities all over the world.

Water Conservation Bibliography is available free to authorities and research workers concerned with this work and copies may be obtained through our Reader Service.

Bulletins and Reports

Connecticut Agricultural Experiment Station. 'The Climate of Shade—A Tobacco Tent and a Forest Stand Compared to Open Fields'. Bulletin 626, December 1959. Obtainable from the Agricultural Station, New Haven, Conn., U.S.A. Price not stated.

Tobacco Research Board of Rhodesia and Nyasaland. 'The Production of Turkish Tobacco'. Obtainable from the Tobacco Research Board, Kutsaga, P.O. Box 1909, Salisbury, Rhodesia. Price not stated.

West African Cocoa Research Institute. 'A Review of the Use of Shade and Fertiliser in the Culture of Cocoa'. Technical Bulletin No. 6. Obtainable from the Cocoa Research Institute, Tafo, Ghana. Price 2*s*. 6*d*.

University of Sydney, School of Agriculture. 'An Account of Research on Irrigated Pastures Applied to a Milk Zone Dairy Farm'. Agronomy Bulletin No. 2, March 1960. Obtainable from the School of Agriculture, University of Sydney, Sydney, N.S.W., Australia. Price not stated.

Royal Institute of Chemistry. 'Some Chemical Aspects of Plant Disease Control' by R. L. Wain. Lectures, Monographs and Reports, 1959, No. 3. Obtainable from the Royal Institute of Chemistry, 30 Russell Square, London, W.C.1. Price 4*s*. 6*d*.

FAO Publications

Food and Agricultural Legislation, 1959. Vol. VIII, No. 3, of a series published quarterly in English, French and Spanish editions. Price $1 or 5*s*. for a single copy.

Plant Exploration, Collection and Introduction by R. O. Whyte. No. 41 of FAO Agricultural Studies. Rome, 1958. Price $1 or 5*s*.

World Forest Inventory, 1958. The third volume in the five-yearly series compiled by the Forestry and Forest Products Division of FAO. Price $2.50 or 12*s*. 6*d*.

Production Yearbook, 1959. Vol. 13. Price $5 or 25*s*.

All obtainable from H.M. Stationery Office, P.O. Box 569, London, S.E.1, or through local sales agents.

Smithfield Show

New Machinery for Maize, Lucerne and Potatoes

THIS year's Smithfield Show was another major step forward in agricultural engineering history.

There were three new tractors and one tractor manufacturer was showing a major new development whereby the engine compression is used for braking, thus adding a most important safety factor to the use of farm tractors.

Machinery for maize and lucerne

With the help of seed merchants, engineers have developed precision seed drills capable of sowing hybrid maize seed, exactly as required, and modifications to the now ubiquitous forage harvester, so that maize can be harvested and lacerated at the same time. The importance of this lies not so much in the reduction in the cost of fattening beef as in the reduction in the amount of land required.

Machinery is also now available which will enable the farmer economically to harvest lucerne, which produces a heavier, richer crop than ordinary hay. The difficulty with this crop in English conditions has been that the leaf has dried before the stalk and, consequently, fallen away. Now, by crushing the stalk, it can be dried at the same speed as the leaf, under normal field conditions.

For the arable farmer, the handling of crops is being increasingly mechanised. This is particularly evident so far as potatoes are concerned. It is now possible for potatoes to be harvested, graded, cleaned, weighed, packed in plastic or paper bags, and despatched direct to retailer in containers, suitable for use with fork-lift trucks.

Freedom-from-hunger

Perhaps the most exciting aspect of this year's Smithfield Show was the meeting between leaders of the British agricultural engineering industry and senior members of the Food and Agriculture Organisation of the United Nations to discuss how the industry can help in the 'Freedom from Hunger' campaign.

The industry has long since recognised that its international position requires it to take upon itself international responsibility. The most recent evidence of its acceptance of this position has been the establishment of the Middle East Agricultural Machinery and Soil Conservation Training Centre at Karaj, outside Teheran. The industry has made a free gift of all the machinery the Centre will require and has agreed to maintain it, whilst accepting that the Centre, in all its aspects will be completely under the control of the Central Treaty Organisation in Ankara.

It has now offered its facilities and its great sum of technical knowledge of the staffs of its member firms to FAO for the duration of the 'Freedom from Hunger' campaign. It will advise FAO's own technicians during the course of the many pilot schemes they will need to undertake, and will, if need be, make or modify the machinery required.

Whilst this is not the first time an industry has co-operated with a United Nations Organisation, it is certainly the first time that an industry has placed all its facilities at the disposal of FAO. This indeed is a practical demonstration that British industry is squarely facing the problems of the less-developed areas of the world.

Reader Service

For further information on any item reviewed in this issue please use the card provided or write to:

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Leonard Hill House,
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England

Details of exhibits

The following is an early review of some of the exhibits at the Smithfield Show this year. There will be a further report in the January issue.

A range of three sturdily-built rotary cultivators was presented by *Allen & Simmonds Ltd.* The smallest —the 'Horticulto'—which is powered by a 1.2-h.p. *Villiers* engine and weighs only 97 lb., is for the gardener and smallholder. The next largest—the 'Universal Autogardener'—primarily for the market gardener and

The latest 'Sapper' Powerdozer has a 6-ft. blade with a reversible cutting edge

The 'Auto-Culto' Mk. V, as fitted with the 20-in. ridging attachment

commercial grower, is powered by a 3-h.p. Villiers engine and has a gearbox with three forward speeds and one reverse, giving ample power and the correct working speeds for ploughing, cultivating, hoeing, hedge-trimming, and timber sawing. Their latest introduction is the 'Auto Culto', Mk. V—a 6.2-h.p., two-wheel tractor designed for heavy work on the small farm, agricultural station and market garden. This is a truly universal machine for, in addition to the above uses, it can be employed as a snow plough and earth mover, for pumping water, for lifting potatoes and for heavy ploughing, ridging and various cultivations. Fitted with a driver's seat, it can be used to draw a 15-cwt. trailer.

Shown for the first time by *E. Allman & Co. Ltd.* was a new grain drier, which has been under test for the last three seasons. They are now able to claim 5% moisture extraction with a throughput of two tons per hour, using only 3 gal. of fuel. The machine is built in sections, and easily transported to another site, no excavation being necessary, and all the power required is supplied by a single 5-h.p. electric motor. In addition to their big range of sprayers, they also included the 'Hypromatic' steady-flow water system for raising water from shallow wells, reservoirs, lakes and streams.

Barfords of Belton Ltd. were again showing their tractor-towed, in-line, flail-type forage harvester, which cuts a 42-in. swath; a rear-mounted ditch cleaner, which can clean ditches of varying shapes and sizes; their 8-bale loader, which made its debut last year; a power scythe with a 3-ft. cutter bar; the 'Atom 15' and 'Atom 30' multi-purpose horticultural tractors, together with implements for ploughing, grass-cutting, cultivating and hedge trimming; their self-priming centrifugal pumps and a selection of dairy equipment, feed mixing and farm cooking apparatus.

A.N.S. rear tractor tyre with rounded shoulders for working on fine lawns where there must be a minimum of damage. It is also suitable for use on sand

The latest version of the well-known 'Sapper' powerdozer was shown by *Bomford & Evershed Ltd.* It has been specially designed for the powerful 4-wheel-drive *Fordson* Super Major and has a reinforced 6-ft. blade with a hardened-steel reversible cutting edge. It is mounted universally on the front of the tractor so as to be able to bulldoze, angledoze, or tilt for operation on sloping sites.

The Bonser 10-cwt. three-wheeler, seen on the stand of the *Bonser Engineering Ltd.*, is just the thing for the commercial grower for transporting planting material, plant pots, fertiliser and supplies into his greenhouses and nursery plots; for the farmer and poultryman for carrying loads of feed and eggs etc. which would not justify the use of his lorry; and for the scientist engaged in field trials at experimental stations. They have also introduced a 1-ton version, which is powered by a 5/6-h.p., 4-stroke petrol engine and might be suitable for carrying bags of tea, coffee or cocoa beans. The 'Agrotiller', which they also showed, is an implement which has already proved its worth.

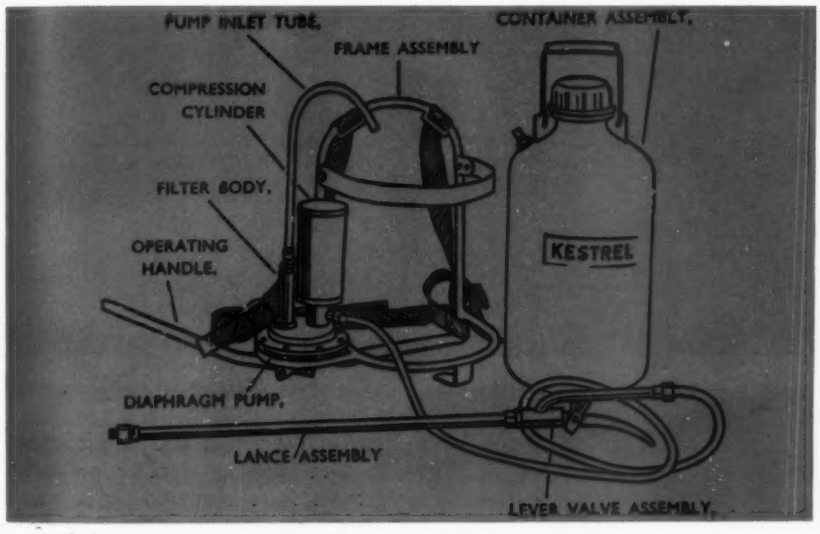
The Lely fertiliser distributor, which comes from Holland, was shown by *Colchester Tillage Ltd.*, together with the 'Lemken' mounted, reversible plough. They offer a choice of share bodies to suit all soil conditions and various purposes—one to produce an unbroken 'ribbon' furrow with all grass and trash at the bottom; another to produce a more broken furrow; and another for heavy stiff land, which is more difficult to turn. There is also a choice of 10-in., 12-in., 14-in., and 16-in. furrow widths. They also showed an H.D. harrow of Danish origin and various types of Flemstofte cultivator harrows, both trailed and mounted.

The *Firestone Tyre & Rubber Co. Ltd.* had an imposing display of their agricultural tyres, designed for special purposes. Thus the All-Traction 'Champion' tyre is for fitting to the rear wheels of tractors, which may be used either for road haulage or for

The Lely fertiliser distributor has six curved spreader arms. With granular fertilisers, a 50-ft. spread is obtained

cultivation operations; the 'Guide Grip' and other ribbed tyres are for fitting to front wheels to give easy steering; the 'Industrial' is a tough tyre for heavy haulage operations, such as logging; the 'A.N.S.' rear tyre has a special tread with rounded shoulders and no sharp edges and this is designed for use on lawns where there must be the minimum of damage; and there were also a number of special tyres for fitting to trailers and drawn implements.

There were two new introductions by the *Kestrel Engineering Co. Ltd.*—the 'Cascader', a tractor-mounted orchard sprayer, and a lightweight



Polypak knapsack sprayer Kestrel showing how the polythene container can be removed for re-filling

mechanical cultivator, the 'Workmate'. The former is a swirl atomiser, which is worked by the p.t.-o. of the tractor and may be attached either to the 3-point linkage or to the toolbar. It has a 35-gal. spray container and the axial blower has eight 'Duro' jets, arranged for two-sided spraying at a maximum row width of 3 yds. The 'Workmate' cultivator is for the commercial grower. It has two gears, which allows two operating speeds to suit various operations—cultivating, hoeing, ridging and ploughing (for lighter soils only). Various types of tines are available, and the machine can operate at a width of 6½ in. up to 46½ in. Special straddling devices enable four rows to be hoed at a time.

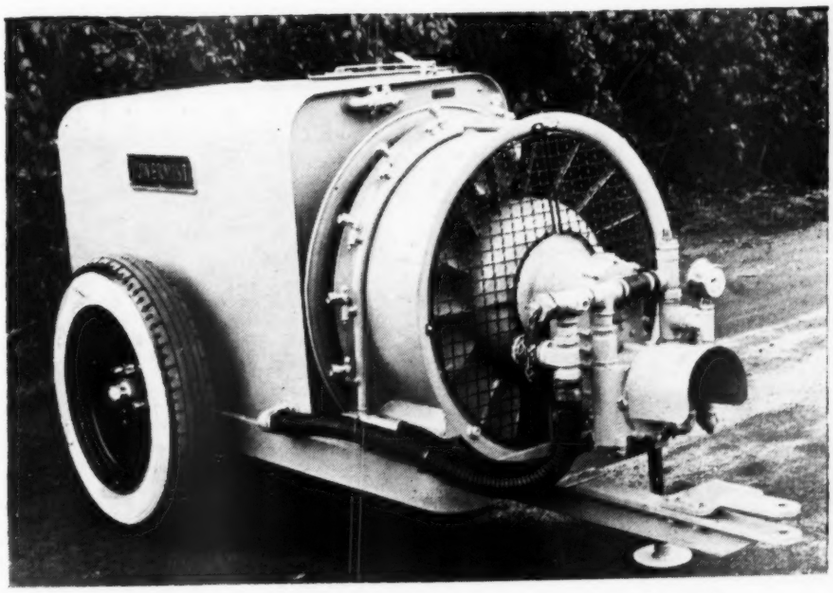
In a romantic jungle setting, *Kent Engineering & Foundry Ltd.* were showing their new motorised knapsack sprayer—the Motoblo 60 mistsprayer and duster—and their new trailer-type Powermist Mk. II sprayer. The former weighs only 27½ lb.; it will deliver up to 1 gal. per min. and reach up to 25 ft. and so has a wide variety of applications.

An interesting new introduction was seen on the stand of *Opancol Ltd.* This was the 'Kleen Gun', which uses the exhaust gases from the tractor to provide heat and pressure to a jet for cleaning hard grease and grime from tractors, manure spreaders, combine harvesters, balers and other agricultural machinery; it can also be used

The 'Kleen Gun' being used to clean an Oliver tractor, with pressurised hot air being supplied from the exhaust

for whitewashing, rustproofing, disinfecting and for burning brush and stubble. They also showed the 'Neptune' high-pressure water pump, the Bayer Universal air compressors, the 'Silometer' thermometer for silage, hay or grain, the 'Quick-test' grain moisture meter, and different types of plastic sheeting.

The centre-piece of the stand of *Scottish Mechanical Light Industries Ltd.* was a fully-automated provender plant for milling, mixing and pelleting balanced rations for cattle, pigs, sheep and poultry on the farm. Also shown were their grain driers and blowers, and the Scotmec-Oxley instantaneous moisture meter for testing the resulting product. All-electric forklift trucks to lift loads of 1,000 lb. and 1,500 lb.,



Powermist Mk. II sprayer, mounted on a 200-gal. trailer tank

Stanhay beet harvester designed for operation with light tractors

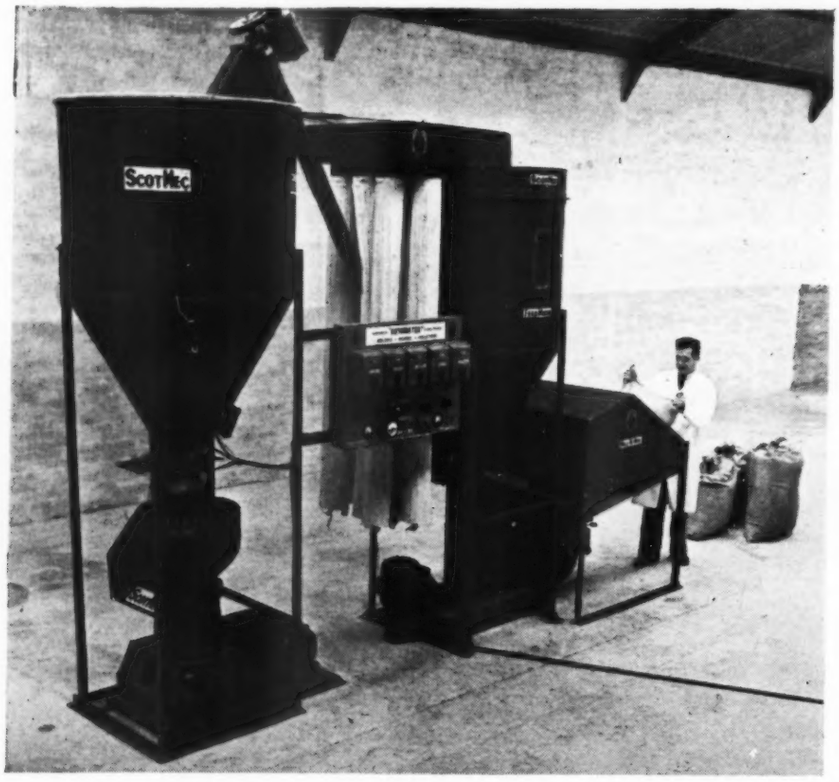
and the Scotmec transport box were also shown.

The *Stanhay* beet harvester, which we first saw at the National Beet Harvesting Demonstration at Peterborough this year, has been designed for operation with light tractors. The machine is self-contained and incorporates a topping unit, cleaning cage, and side elevator; it is attached to the 3-point linkage and is driven from the p.t.-o. of the tractor. This machine was shown, together with the 'Windrum' haymaker, Stanhay seed-spacing drill, and the 'Super Ditch-master', which was seen in motion.

Mechanical saws which can be powered by the engine of a lawn mower, rotary cultivator, tractor, independent engine unit, or even a car battery through a flexible shaft, were shown by the *Tarpen Engineering Co. Ltd.* One of the most important machines from the point of view of the farmer is their new 17-in. hedge cutter, which weighs only a little more than

The 17-in. Tarpen-Strand hedgecutter

10 lb. It is designed to cut growths up to $\frac{7}{8}$-in. thick; if older or thicker growth is encountered, it is only a matter of seconds to fit their rotary pruning saw or their chainsaw—the former will cut branches up to 3 in. in dia. and the latter has a 10-in. cutting capacity.



The Scotmec provender plant comprises a low-level feed bin, a hammermill, a feed mixer, an auger conveyor, a vibrating feed bin, and a cam-operated cubing and pelleting machine (R. to L.)

The *Vigzol Oil Co. Ltd.* were showing their crop-spraying machines, agricultural chemicals and foliar nutrients. The 80-gal. 'Yeoman' low/high-volume machine was exhibited for the first time; its spray tank has a double resin coating and the copper piping is laid in channel sections for better protection. The ancillary equipment shown included special booms for under-leaf spraying of ground crops, a band spraying boom for row crops, and booms with side attachments for fruit trees and hops. Various approved chemicals for the control of weeds in cereal crops and leys were displayed, together with 'Naturfeed'—a foliar nutrient containing NPK with certain trace elements added.

Agricultural Chemicals

Mill Scale on Steel Plate

Another step forward in the overall battle against corrosion of agricultural machinery has been taken at the Thornton Research Centre of *Shell Research Ltd.*, where a quick, simple and inexpensive method of checking the completeness of removal of mill scale from steel plate has been developed.

As received from the steel mill, sheet steel is covered with mill scale, or magnetic iron oxide, which in itself is immune to corrosive attack. However, for two reasons this scale is undesirable: firstly, it presents a surface which is not a good base for paint; and, secondly, if it is scraped off heavy pitting occurs.

Its removal by shot-blasting is therefore an important step in the overall protection of steel, but some method is needed for measuring the effectiveness of this operation, for a surface that might appear clean to the eye might still be covered with enough residual scale to reduce the protection given by paint.

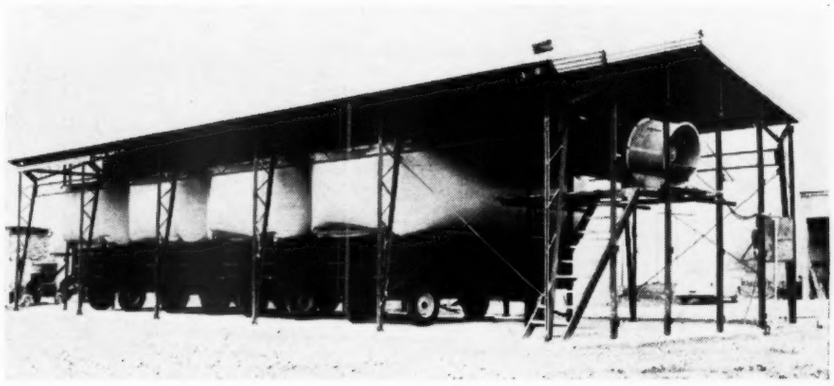
This problem has been solved by the application of a solution of copper sulphate to the freshly blasted steel surface. Areas entirely free of mill scale become coated with copper, while any scale still remaining shows up as a dark area against the copper background. The test takes only a few seconds and needs no other equipment than an impregnated pad or sponge.

Nitrogen and Wheat

According to a report published by the *Nitrate Corporation of Chile*, sodium nitrate has produced 25% greater accumulation of nitric nitrogen in wheat seedlings than did calcium nitrate. The accumulation of organic nitrogen was also higher.

It is concluded from this that wheat seedlings absorb nitric nitrogen more effectively from sodium nitrate than from calcium nitrate. This effect is attributed to the effect of sodium in improving the permeability of the protoplasmic membrane.

A copy of the report can be obtained through our Reader Service.



Four lorry loads of hay being dried under coated nylon hoods. The lorries can be moved away when the contents of each vehicle are ready

Hay Drying

A vinyl plastic coating from the U.S.A. can help farmers to solve grain- and hay-drying problems outdoors—even in the rain.

In an unusual new application, grain and hay can be dried by the wagon - load under nylon hoods, covered with a coating based on a vinyl resin, made by *The Goodyear Tyre and Rubber Co.*

High air volume and large quantities of fuel heat, thoroughly blended for safe drying, are supplied by a crop dryer made by the *New Holland Machine Co.* in America. As many as four wagon-loads can be dried simultaneously under the airtight hoods, according to the manufacturers.

The exact amount of heat required for drying a particular type of grain or hay can be obtained by adjusting the temperature controls.

The coating used on the nylon is made from 'Pliovic WO', a specialty vinyl resin produced by Goodyear Chemical Division. According to *Cooley, Inc.*, producers of the coated fabric, the vinyl plastic can be fused to the nylon at low temperature without weakening the basic fabric.

New Resin for Plastic Pipes

A new black plastic resin—'Marlex TR-212'—a high-density polyethylene manufactured for the production of plastic pipes, has been announced by *Phillips Chemical Co.* Leading pipe producers in the U.S.A., they are now extruding N.S.F.-approved pipe in sizes from ½ in. to 2 in. from this new material, which is particularly recommended by the manufacturer for cold water lines as used in artesian wells, farm irrigation and water supplies, lawn sprinkler systems and in greenhouses.

Its flexibility makes it possible to supply it in coils and this, together with its lightness, permits the laying of long lengths with obvious economies in time and labour. The resin is stated to be inert to acid or alkaline soil and does not conduct electricity.

For Fire-Fighting

Black polythene film, produced by the *Union Carbide Co.*, is being used to line water storage tanks in the forests of Canada to prevent loss of water by seepage. The ponds are dug in a shady spot to reduce losses by evporation and intended to provide water for fighting fires in dry areas in remote spots to which it is not practical to pump water. The banks of the ponds have a 45° slope, being 15 ft. square at the top and 12 ft. square at the bottom. A sheet of 8-mil (0.2-mm.) polythene sheeting 26 ft. square is laid over the bottom and sides of the pit and anchored with soil.

Canada's forest annual loss over the past 10 years has been over U.S. $10 million and an average of nearly 1½ million acres has been lost every year.

Chemical Nomenclature
3. Organic Fungicides

Chemical Group and Name	*Trivial Name Proposed or Accepted*	*Trade Marks of Some Formulations in Common Use*
N-trichloromethylthio*cyclo*hex-4-ene-1,2-dicarboxyimide	captan	'Orthocide 406'
manganese ethylene-1,2-bisdithiocarbamate	maneb	
zinc ethylene-1,2-bisdithiocarbamate	zineb	
zinc dimethyldithiocarbamate	ziram	
ferric dimethyldithiocarbamate	ferbam	
2,3-dichloro-1,4-naphthaquinone	dichlone	'Phygon'
salicylanilide		'Shirlan'
tetrachloro-p-benzoquinone	chloranil	'Spergon'
tetramethylthiuram disulphide	TMTD thiram	
disodium ethylene 1,2-bisdithiocarbamate	nabam	
2,4-dinitro-6-(2-octyl) phenyl crotonate	karathane	
n-dodecylguanidine acetate	dodine-acetate	'Cyprex'
1,2,4,5-tetrachloro-3-nitrobenzene	tecnazene TCNB	
pentachloronitrobenzene	PCNB quintozene	'Tritisan'
methylmercuric dicyandiamide		'Panogen'
2-methoxyethyl mercuric chloride		'Aretan'
N-(ethylmercuri)-p-toluene sulphonanilide		'Ceresan "M" '

4. Soil Fumigants

mixture of 1,3-dichloropropene and 1,2-dichloropropane		'DD'
dibromochloropropane		'Nemagon'
sodium methyldithiocarbamate	metham sodium	'Vapam'
2,4-dichlorophenyl diethyl phosphorothionate		'VC-13'
trichloronitromethane	chloropicrin	'Picfume'
ethylene dibromide (1,2, dibromoethane)	EDB	'Nematox'

World Crop Reports

INTERNATIONAL REPORT

Sunflower seed

World sunflower seed production in 1959, estimated at 5.3 million short tons, was a quarter below the record 1958 crop but more than 1 million tons greater than the average output in 1950–54. Prospects for 1960 are for a near return to the 1958 level of production.

North American sunflower seed production, all in Canada in recent years, expanded sharply in 1959. The Canadian Government and oilseed processors have been encouraging larger acreages of sunflower in Manitoba and Alberta, and the acreage will probably increase still more in 1960.

Sunflower seed has been the main edible oilseed crop grown in *South America*. Production is now centred in Argentina, Chile, and Uruguay. Last year's crops were greatly reduced in Argentina and Uruguay, following heavy spring rains and extensive damage from insects and disease. The recently harvested 1960 crop in Argentina is estimated at 811,300 tons and Uruguay's 1960 outturn is estimated at 87,800 tons.

Small quantities of sunflower seed were produced in France, Italy, and Greece, but production was mainly in *Eastern Europe*. Four countries—Bulgaria, Hungary, Rumania, and Yugoslavia—produced 97% of the region's outturn in 1959. A sharp rise in Rumania's crop last year was due mainly to increased acreage, but the weather also was favourable. The long drought which hit Northern Europe and the U.S.S.R. last year did not extend into the sunflower-producing regions of south-east Europe.

The year - to - year changes in *U.S.S.R.* production largely determines the annual variations in total world production, because the U.S.S.R. crop is roughly two-thirds of the total. Unlike Russian cottonseed, which is produced mostly under irrigation and varies little each year, sunflower seed is grown on unirrigated land. Thus, a serious drought such as that which occurred during the summer and autumn of 1959, sharply reduces the output. Reports on weather for 1960 indicate a fairly good season and this year's acreage is believed to be slightly above 1959.

Turkey produces most of the sunflower seed grown in *Asia*. The 1959 crop there was somewhat above the 1958 crop, reflecting the favourable weather of south-eastern Europe which extended into Turkey.

REGIONAL REPORTS

Argentina

The first official estimate of *flaxseed* plantings for 1960–61 was 2,866,360 acres, slightly higher than the 2,824,000 acres in 1959–60. The acreage actually planted is expected to be higher than the first estimate, since plantings could continue through the month of September in the important growing areas of Entre Rios and Buenos Aires provinces. The most important flaxseed province, Entre Rios, showed a 17% increase in acreage over last year.

The final estimate of the *groundnut* crop for 1959–60 is 230,711 short tons, 13.1% less than last year and 11.6% below the last 5-year average. The decline in production is mainly due to a 23.5% decline in acreage planted, due to dry weather during planting time.

India

India's 1959-60 *rice* crop is now officially estimated at 29.4 million long tons of milled rice. This is 1 million tons less than the partially revised estimate of 30.4 million for the previous year, which was a record.

The acreage of 81.3 million acres under this crop was still below the 81,437,000 acres estimated for 1958-59. The area decrease, mainly in the winter crop, was attributed largely to unfavourable sowing weather. The big rice-producing states of Uttar Pradesh, Bihar, Madhya Pradesh and Bombay accounted for most of the production decline. The smaller harvests in Bihar and Uttar Pradesh were partly due to acreage reduction and partly to drought during the growing period. In Bombay and Madhya Pradesh heavy rains and floods affected the crop.

The 1959-60 *flaxseed* crop was 17 million bushels from 3.9 million acres, according to the final estimate. This is 5% less than the 1958-59 out-turn, revised to 17.9 million bushels from 4 million acres. This 1958-59 crop was the largest for nearly 20 years.

The 1959-60 decline in production is attributed to reduced acreage and less favourable weather.

Indian *rapeseed* and *mustard seed* production in 1959- 60 is estimated at 1.2 million short tons. This is an increase of 1.1%, or 13,000 tons, over last year. Acreage in 1959-60, at 7.2 million acres, was up 19% from 1958-59, but yields were lower this year because of less favourable weather during the growing season.

Thailand

The acreage under *maize* in Thailand has been increasing steadily since 1950 and this crop is now second to rice in value of production. Most of the maize crop is produced for export, only a small amount being used to feed poultry.

Yields per acre during the past ten years have also risen and in 1959 were reported to be just under 20 bushels per acre. While this is about double the low yields reported for 1950, it is still below the possibilities of the area, according to agricultural experts who believe that soil and climate in much of the north and north-east are such that higher yields are possible with proper cultivation and the use of fertilisers.

Canada

Canada's first forecast of the 1960 grain crop indicates a larger total harvest than the small 1959 outturn.

Wheat production is provisionally forecast as 473 million bushels, compared with 414 million a year ago. *Barley* production of 211 million bushels is 15 million less than last year. but the decline is offset by an increase in oats—442 million bushels, compared with 418 million in 1959. *Rye* production, as forecast at 10 million bushels, is above the 1959 crop of 8 million bushels.

This year's *flaxseed* crop is expected to be 26 million bushels, nearly half as much again as last year's out-turn, now

revised to 17,719,000 bushels. Acreage was increased by almost one-third and average yields at 9.3 bushels per acre are 13% greater than in 1959.

Rapeseed production is placed at 604 million lb. Although acreage was increased 2½ times, average yields at 799 lb. per acre are 4% below those of last year.

Production of *mustard seed* is forecast at 77 million lb., compared with the 1959 out-turn of 49 million. Yields, at 499 lb. per acre, are 19% lower than last year on average.

Greece

Tobacco plantings in 1960, which are estimated at about 236,000 acres, were 6.3% less than last year. This reflects the downward trend for the fourth consecutive year. Smaller acreages have resulted from the Government's policy of limiting production and preventing further accumulation of tobacco stocks.

In 1959, Greece produced a tobacco crop of about 176 million lb. Assuming that yields will be about the same, the crop from the even smaller acreage this year, will be about 165 million lb.

Venezuela

An estimated 148,000 acres will be planted to *sesame* in Venezuela in 1960, an increase of about 20% from the estimated acreage in 1959. It is reported that, in order to expand acreage, 100 tons of seed, to be purchased in Nicaragua, will be required.

A proposal to establish an experiment station for the crop is being considered. It is proposed that the station would be established at the Agricultural Colony of Turen in the central region, where most of the sesame seed produced is now grown.

Peru

Cotton production in Peru for 1959–60 was estimated at 516,000 bales, slightly less than the 1958–59 crop of 518,000. The decline occurred in areas producing 'Pima' and 'Karnak', due to disease and unfavourable weather. Production of these two varieties was around 114,000 bales during 1959–60, compared with 120,000 bales a year earlier, while the 1959–60 production of 'Tanguis', 'Acala', and 'Aspero' totalled 402,000 bales, against the previous year's crop of 398,000. The 1960–61 crop of 'Pima' and 'Karnak', most of which is harvested during July and August, is reported to be about equal to last season's crop.

Uruguay

The 1959-60 *sunflower seed* crop is estimated at 87,830 short tons, 65% higher than the previous year. Groundnut production totalled 6,600 tons (unshelled basis), double the 1958-59 output.

Oil production from this year's sunflower and groundnut crops is estimated at 17,750 tons and 1,750 tons respectively for a total of 19,500 tons.

U.S.S.R.

Although the current 7-year plan of economic development calls for increased agricultural production primarily through higher yields, reclamation is being done not only in the 'new land' areas of Kazakhstan and Siberia, but also in the European section of the U.S.S.R.

In Kazakhstan, over 3 million acres of virgin land have been ploughed this year. Elsewhere, in the Rostov Oblast in the heart of the Soviet winter wheat belt, the area sown to maize and small grains (primarily wheat) is to be expanded by ploughing up 494,200 acres of virgin land, and 123,550 acres of pasture. In the Poles'e region of the Ukraine, 494,200 acres of land are to be drained and reclaimed during the seven years—1959–65. In spite of the soils in this region being infertile, having poor moisture retention and requiring heavy annual fertilisation, the collective farmers in the region intend to drain and reclaim three times more land than was originally planned and to complete the reclamation work in four rather than seven years.

Increased acreage has indeed been a major factor contributing to the rapid and substantial increase in agricultural production during recent years. In 1954 the Government inaugurated a programme of large-scale acreage expansion, now known as the 'new-lands" programme. In seven years, the area under crops had been increased by 113 million acres, relative to 1953, but the period of most rapid expansion was 1954–56 when almost 93 million acres of additional land was put under crops. The acreage of sown crops declined a little during 1957 but has since increased slightly each year, reaching a total of over 500 million acres in 1960.

These so-called 'new-lands' are located mostly in the sub-humid and semi-arid zones of Asiatic U.S.S.R., east beyond the Volga River and the Ural Mountains, where the climate causes fluctuating yields and results in a low average out-turn, even on the fertile Chernozem and Chestnut soils. These conditions apply to most of the potential additions to the cultivated area, for the available acreage for further expansion is mostly located in regions adversely affected by aridity or with short growing seasons, or both.

Expansion of the arable acreage in the U.S.S.R., however, has not been restricted only to the eastern regions. In parts of the Ukraine and North Caucasus, pasture and natural grasslands have been seriously reduced by the plough. Although these regions have a favourable climate and fertile soils, any substantial increase in sown acreage seems unlikely.

Despite its total of 5½ thousand million acres, the U.S.S.R. has actually only about 530 million acres of cultivatable land, for three-quarters of the land consists of deserts, mountains, swamps, tundra and forest.

Eire

While three-quarters of the grain crop had already been harvested by the first week in October, the heavy rains seriously damaged prospects of recovering the balance of stacked corn in some areas. There will thus be a smaller harvest than last year, though the over-all picture was not as bad as was originally feared.

The *sugar-beet* crop promised to be quite good, when harvesting began in early October, but the yield and sugar content was expected to be below 1959 levels.

A bad *potato* crop was expected. In many cases, effective spraying of the crop was not possible through heavy rain during the summer and there have been indications of blight in many districts.

Reports from many counties indicate that the *apple* crop, however, is the best for some years. The fruit in some cases is rather small, due to lack of sun; nevertheless, the quality is good.

Acknowledgment is made to *For. Crops & Mark.* for much of the information contained in the above reports.

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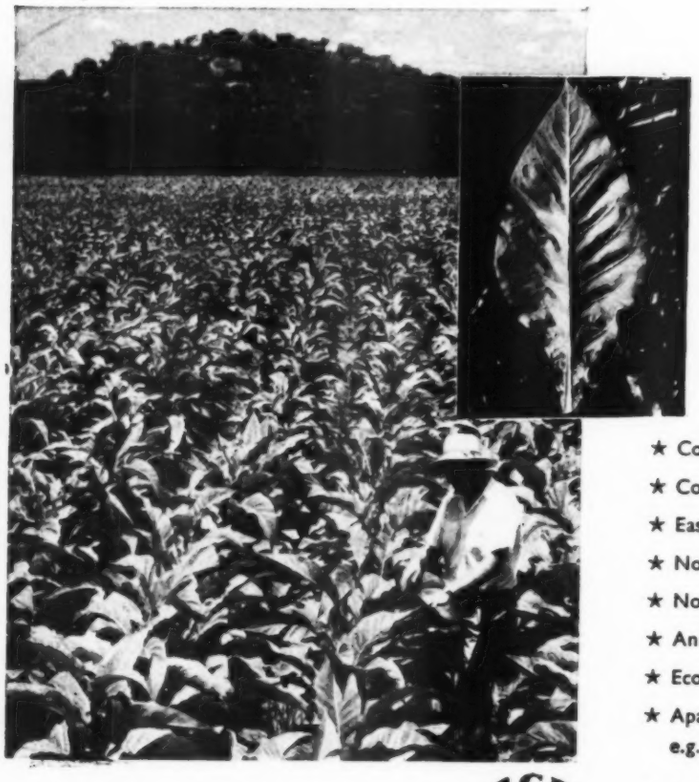

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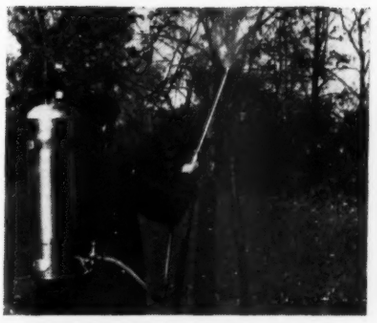

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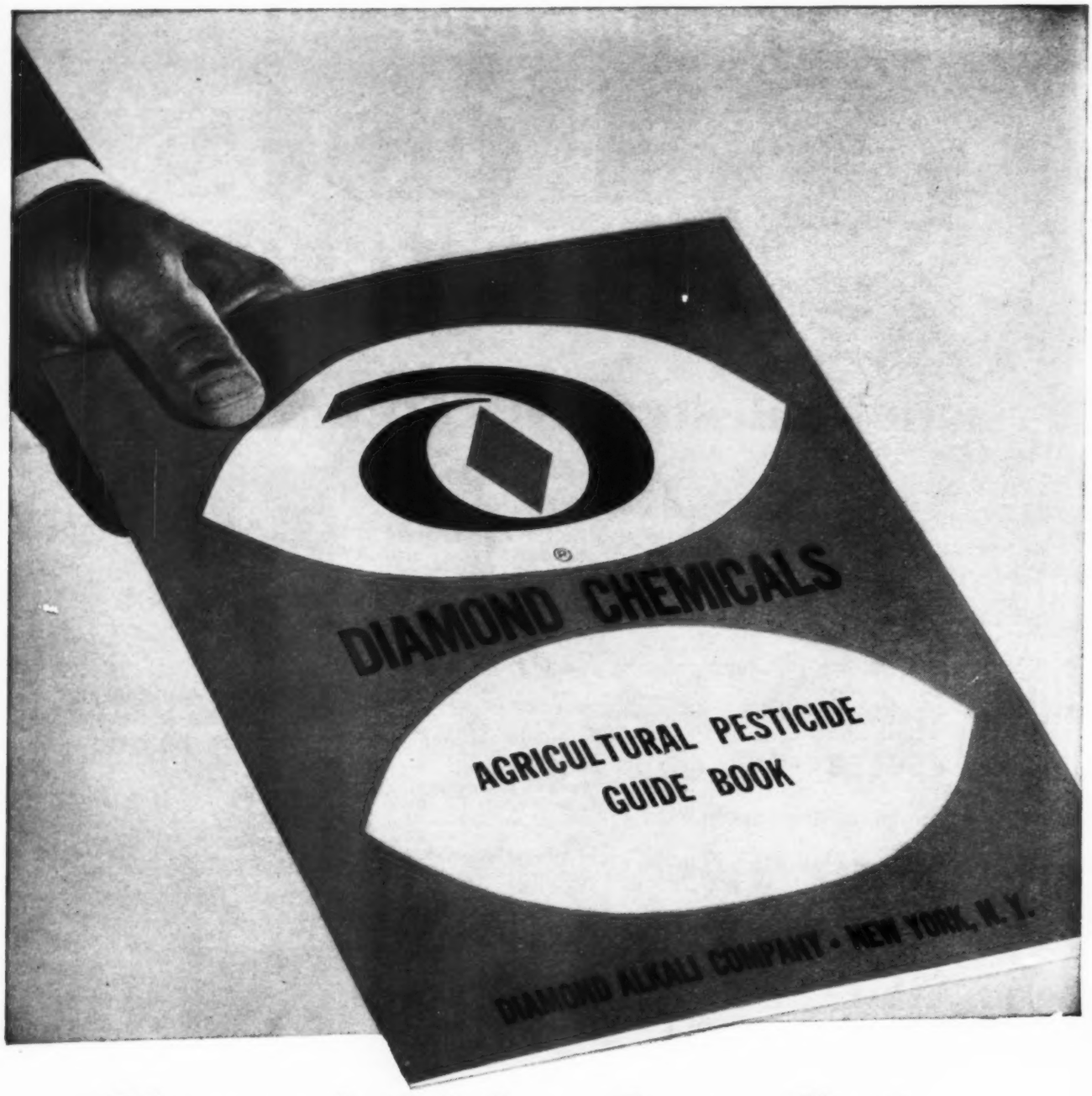

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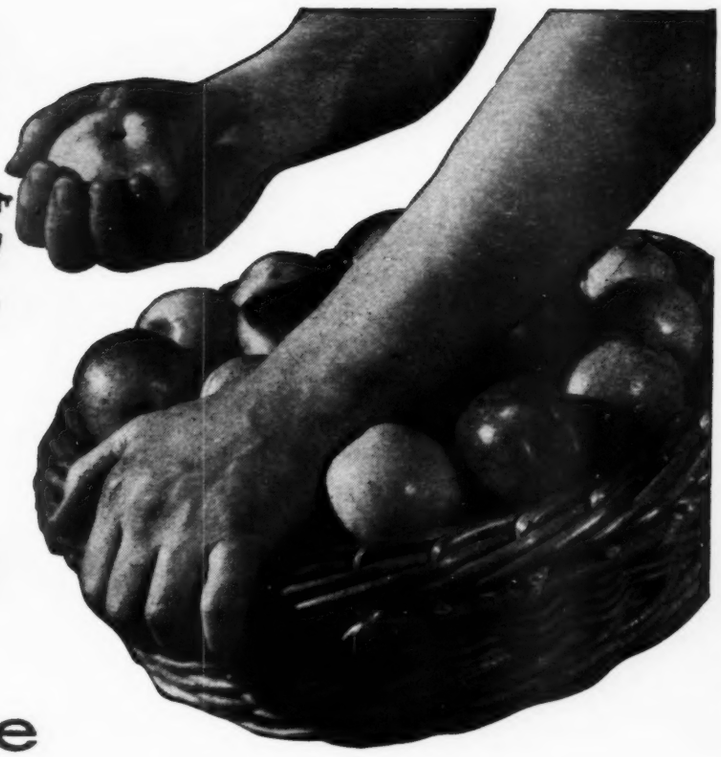

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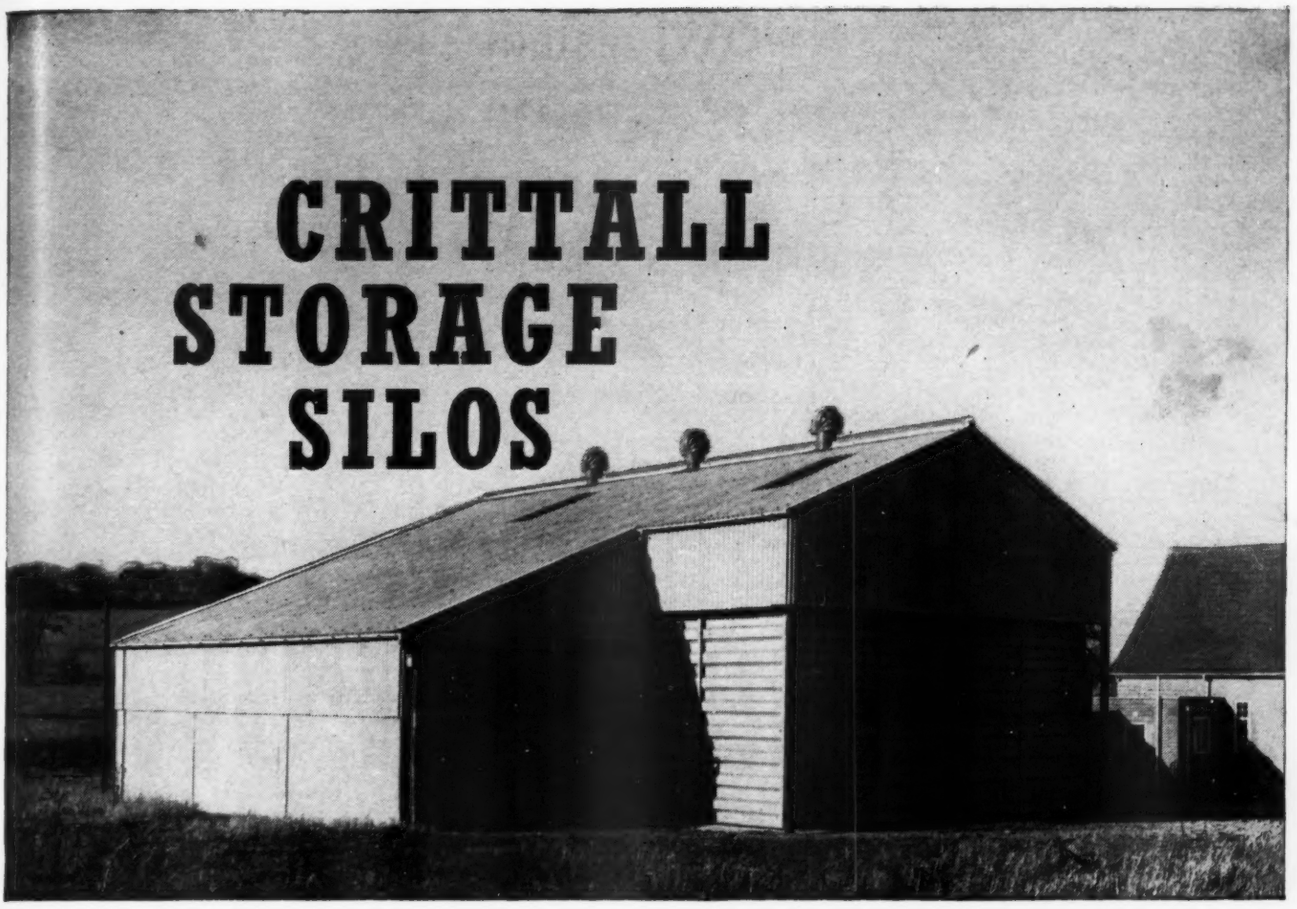

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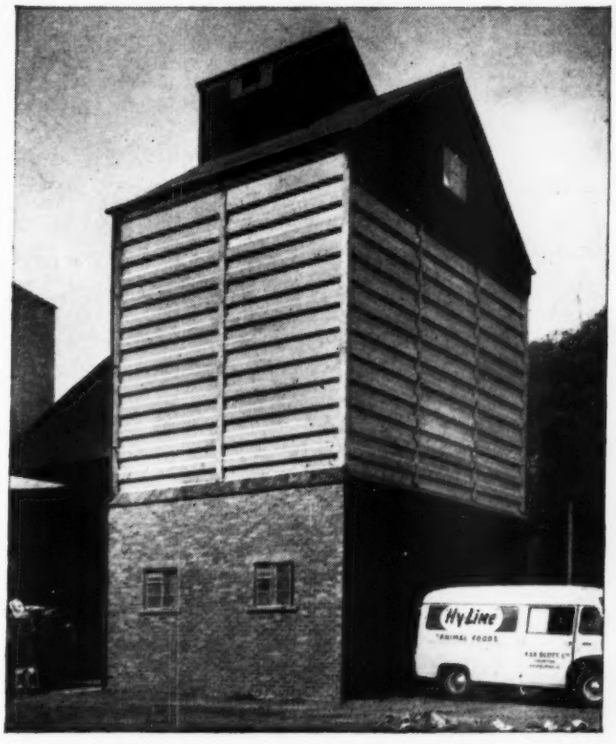
- *Supplied in sections, simple to handle and easy to erect with unskilled labour.*
- *Additional two or three sided bins can be added to existing installations.*
- *Wide range of sizes to meet varied requirements.*
- *Self-supporting when secured by holding-down bolts to a base. When fixed to supporting steelwork bins can be supplied with self-emptying hoppers.*

Made by Crittall, the window engineers of international reputation, these Silos are of deeply corrugated pressed steel sheet, rust-proofed by the Crittall Hot-Dip Galvanizing process.



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DEPARTMENT W/12 . HEAD OFFICE · BRAINTREE · ESSEX ENGLAND Agents throughout the world

NOW! Instant
gear-or-direction
shifts
under full load!

Cat D8H with new POWER S

Available from either Great Britain or U.S.A.

How Cat D8H + Power Shift Transmission = Higher Production

Total engine power is divided by a planetary gear set—part through direct drive to the transmission, remainder through a torque converter, to combine positive operation with flexibility. A single finger-tip control replaces gearshift, forward-reverse and flywheel clutch levers—shifting is so easy, with minimum operator fatigue, resulting in increased production. On push-loading, bulldozing, all heavy earthmoving jobs, the mighty Cat D8H with Power Shift brings you faster operations, shorter cycle times, greater productivity. See your Cat Dealer for complete details on the new Cat Power Shift . . . how it works . . . its operating ease . . . its improved productivity.

The CAT D8H is also available with Direct Drive or Torque Converter.

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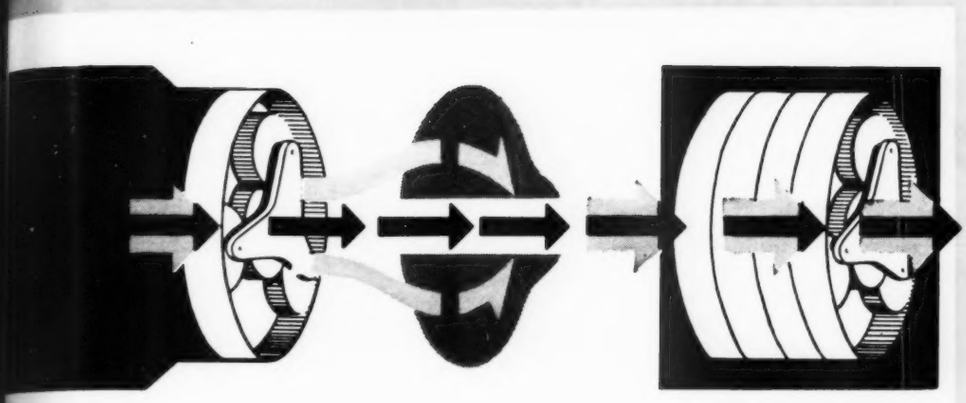
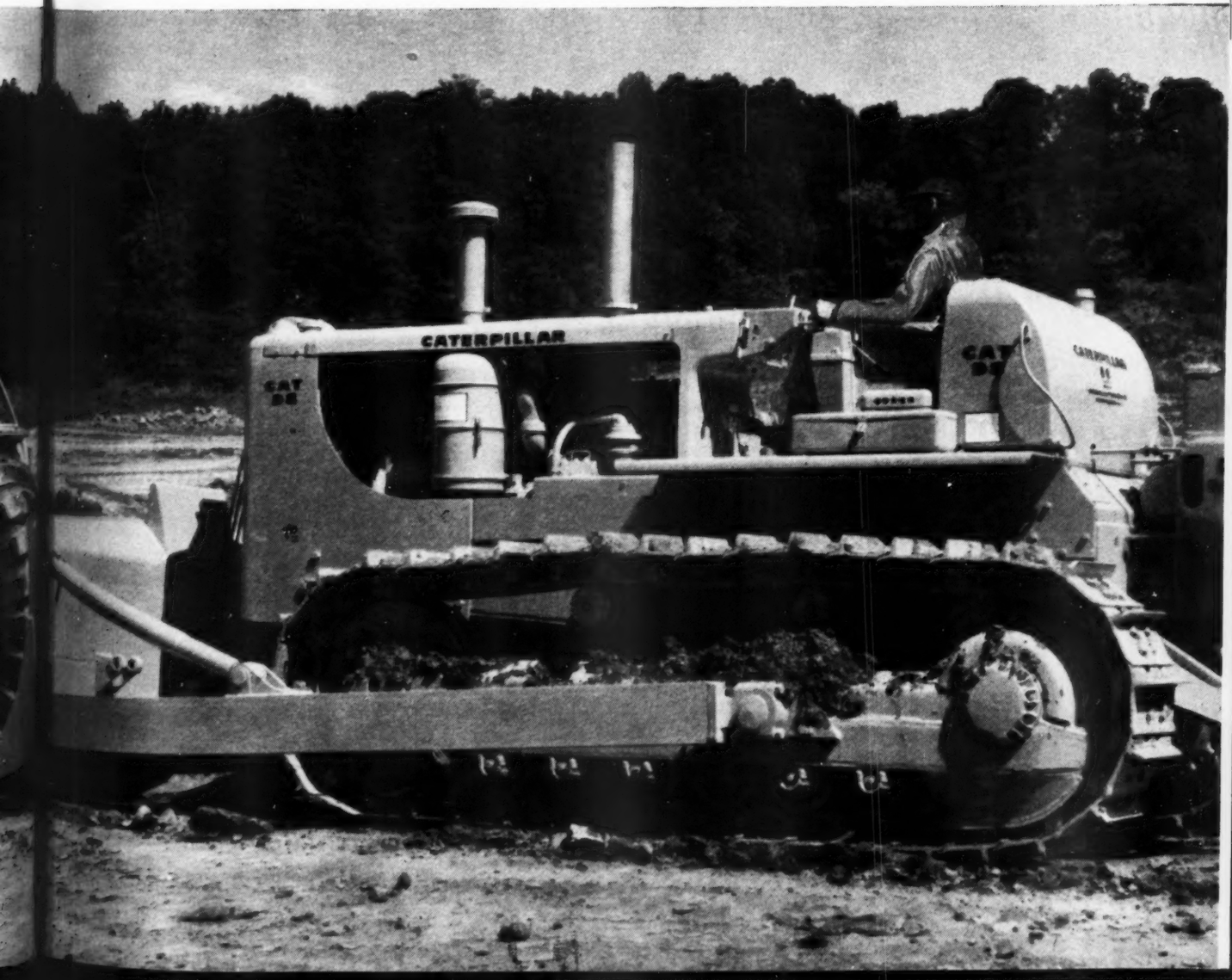


To the impressive strength of the Cat D8H is now added POWER SHIFT, the revolutionai new Caterpillar transmission tha *combines the positive operating efficiency of direct drive with the anti-stall and flexibility features of torque converter.* Even on the toughest, track-type jobs, this means split-second, clutchless gear-or-direction shifts under full load without loss of power.

R SHIFT TRANSMISSION



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From Costa Rica to Australia The Horn-draulic Loader is doing a grand job of work—all-the-year-round. *It is a really tough*, rugged powerful Loader that will load, lift high and dump easily, without effort—*a one-man performance that gets the job finished faster*. The Model "58" Loader has a 13 cwt. lifting capacity to a height of 9′ 8″. Its even load distribution allows maximum wheel adhesion and instantaneous load discharge is assured by a quick release wire rope trip mechanism. The unique design of the Model "58" Loader affords easy access to the tractor driving seat and the most important point of all is that it can be fitted to all popular makes of tractors with upright or down swept exhaust.

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LOOK AT ITS RANGE OF LABOUR-SAVING ATTACHMENTS

Tine Bucket, Dirt Buckets, Fork Lift, Loader Boom, Root Crop Bucket, Scoop, Bulldozer Blades and Hedge Cutter. Every attachment is easily fitted or removed in a few minutes. Save time, labour and money all-the-year-round with the Model "58" and its attachments.

Agencies available in some territories. Enquiries invited

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M-W.166

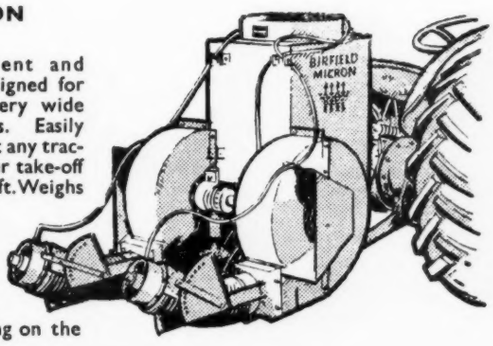
There's a MICRON SPRAYER to give maximum protection for every crop

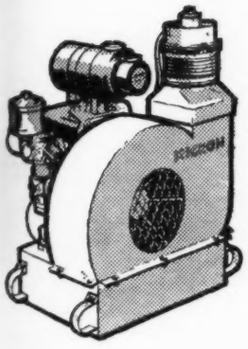
THE MICRONETTE

Ideal for use on cocoa, coffee, banana plantations, etc. A most economical lightweight concentrate sprayer, available as a shoulder-mounted or trolley unit.

THE MICRON TWIN

Highly efficient and powerful—designed for spraying a very wide range of crops. Easily fitted to almost any tractor with power take-off and hydraulic lift. Weighs only six cwts. when fully charged with liquid, sufficient for 6 to 30 acres depending on the crop.



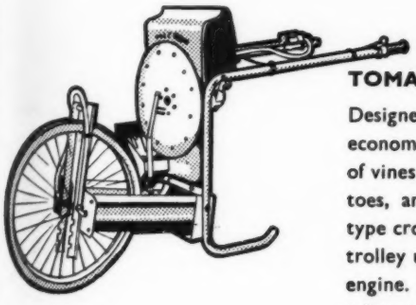


THE PORTABLE 420 & 150

Stretcher mounted concentrate sprayers, suitable for many applications. The Portable 420 is carried by four people, and the lighter Portable 150 by two.

THE MEG

A highly versatile tractor-mounted sprayer with independent engine and single directed outlet. The tank contains 35 gallons, sufficient for 7 to 35 acres at one filling, according to the problem.



TOMATO SPRAYER

Designed for speedy economical treatment of vines, outdoor tomatoes, and other hedge type crops. It is a light trolley unit with 34 c.c. engine. Spray tank contains sufficient liquid for approximately one acre.

In the extensive MICRON range, there's a Sprayer specifically designed for every need, from smallholder to plantation owner. Only MICRON concentrate spraying, with the unique Rotary Atomiser, gives *complete* crop protection, ensuring maximum clean crops free from pests. And MICRON Spraying is most efficient and economical—it halves spraying time, and saves 30% - 40% on chemicals and 95% on water.

only MICRON *has the ROTARY atomiser*

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HALF AN ACRE IN HALF AN HOUR!

The Landmaster 150 was designed first and foremost to speed up farming in the tropics, so it's right at home in paddy field cultivation. Its unique reversible plough, working right or left at the throw of a lever, ploughs up to $\frac{1}{4}$ acre per hour and it puddles and levels up to $\frac{1}{2}$ acre in half an hour, dry or flooded. It is completely sealed against water, weighs only 140 lb. and has only 2 controls.

The Landmaster 150 with its 21-job versatility, extremely reasonable price and wide range of sturdy equipment is the machine for you, wherever you farm, whatever your soil. Send for literature and prices now.

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CRC LEX 13

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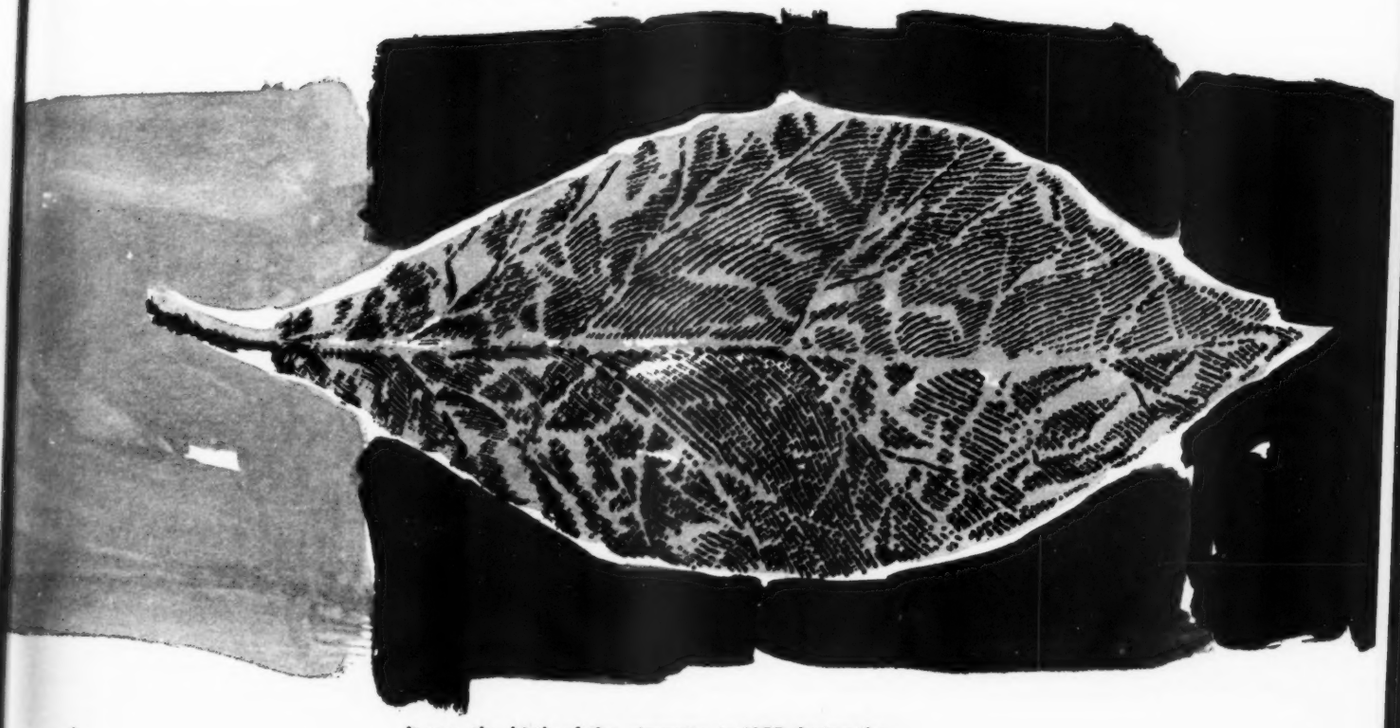
Tobacco – a world power

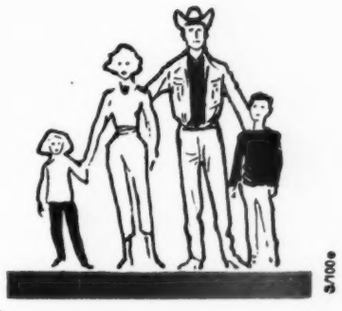
Tobacco exercises a striking influence on modern life. It adds to enjoyment. It gives life zest. In particular, cigarettes have become virtually indispensable to half the world's population.



It was the birth of the cigarette in 1855 during the Crimean War that started tobacco on its rise to economic world power. Today consumption of tobacco can be regarded as a yardstick for a country's standard of living. By 1920, the world tobacco crop had expanded to 2.3 million tons. Today, at roughly 4 million tons, it has almost doubled again. Consumption per head in some countries is as high as 4 to 6 pounds a year.

Tobacco is a vital crop in Asia, North and South America, Europe and Africa. The quality of its different kinds depends to a great extent upon correct fertilization. Above all, nitrogen is essential for the healthy growth of tobacco plants, and its application at the earliest possible stage is particularly important.

Nitrogen from Germany primarily comes from the Ruhr area: from RUHR-STICKSTOFF AG at Bochum. This firm is the nitrogen sales organization of 8 factories producing synthetic nitrogen fertilizers and of a great number of coking plants. RUHR-STICKSTOFF is one of the world's largest nitrogen exporters. Its products help to achieve more and better crops in more than 90 countries.



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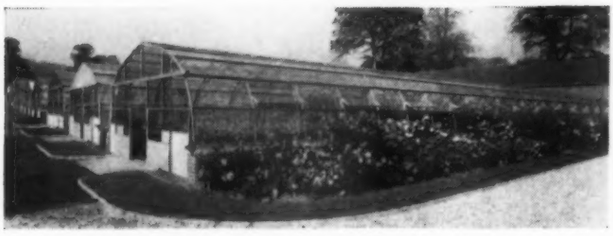

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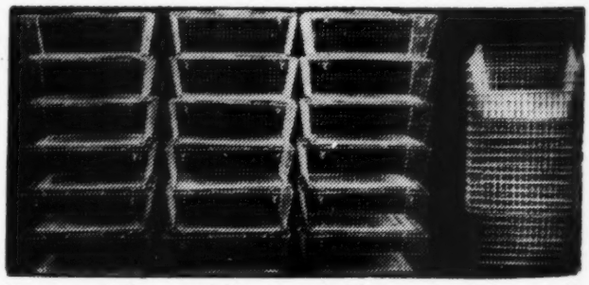

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(MERCURIZED COPPER OXYCHLORIDE)

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The eradicant property of the mercury content of M.C.O. allows a much lower rate of application resulting in less "copper shock" and a great saving in cost.

We also combine M.C.O. with Maneb (M.C.O.M.) and Zineb (M.C.O.Z.) for use where either of these thiocarbamate fungicides is considered desirable.

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STAND 28 SMITHFIELD SHOW

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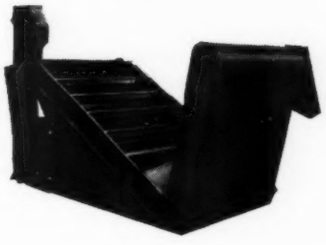

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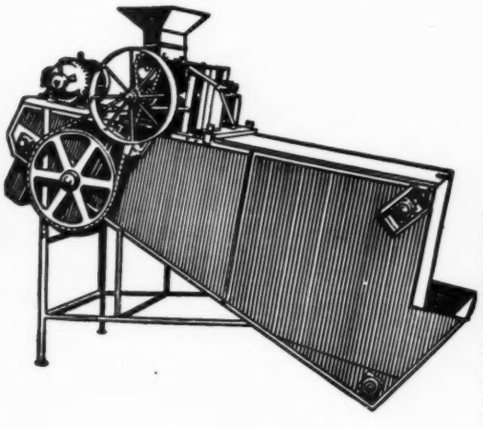
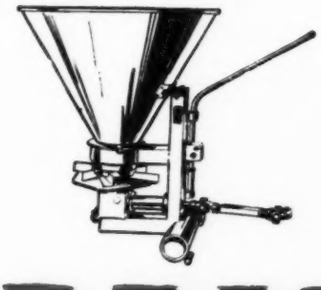
COMBINED
ROLLER GRINDER MIXERS



FERTILIZER SPREADERS



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Thermostatically controlled diesel firing.
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For all kinds of grain including seed corn and malting barley. Also grass, clover and beet seed, coffee, coir, wool.
The grass and dual purpose driers are designed to deal both with long grass and gang mowings.
Driers are delivered to site by our own transport.

OUTPUTS:
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ELEVATORS, CONVEYORS
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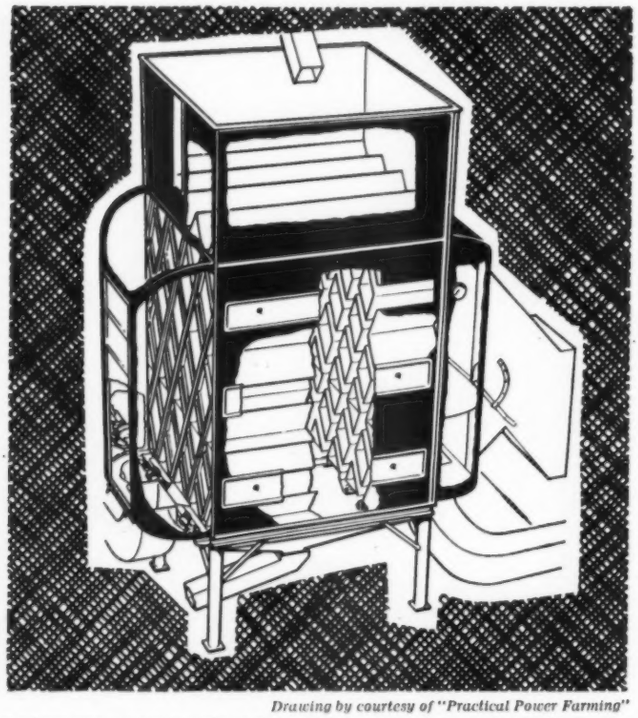
GRAIN DRIER *AN OUTSTANDING CONTRIBUTION TO MODERN FARMING*

STAND 132



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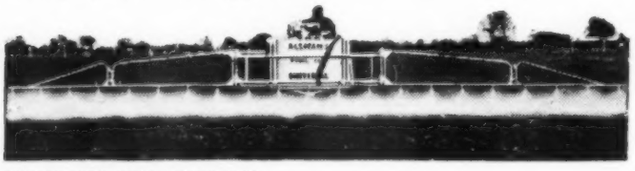

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High/low volume Sprayer for large areas. 100 gallon tank, 20 ft. spraying width. A great machine.

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Medium/low volume field Sprayer. 60 gals. capacity, spraying 2½ to 75 gals. per acre.

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Low volume Sprayer. 40 gals. capacity, spraying up to 40 gals. per acre.

ALLMAN 'SUSSEX' FERTILISER SPREADER.

Spinner type Spreader. A most useful machine.

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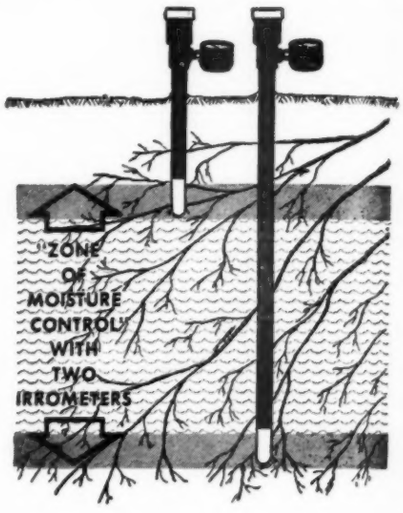

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Diameter now reduced to 7/8". Easier to install. Complete range of sizes: 6", 12", 18", 24", 36", 48".

NEW Air Free Gauge
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NEW Reservoir
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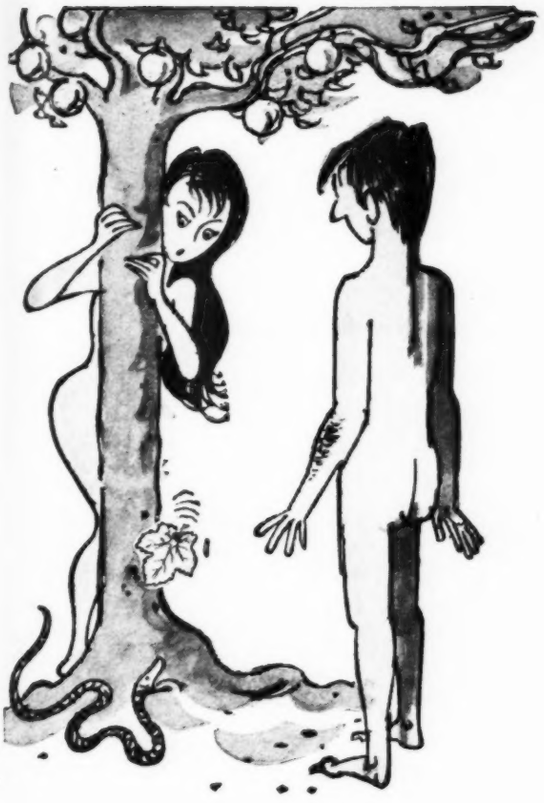

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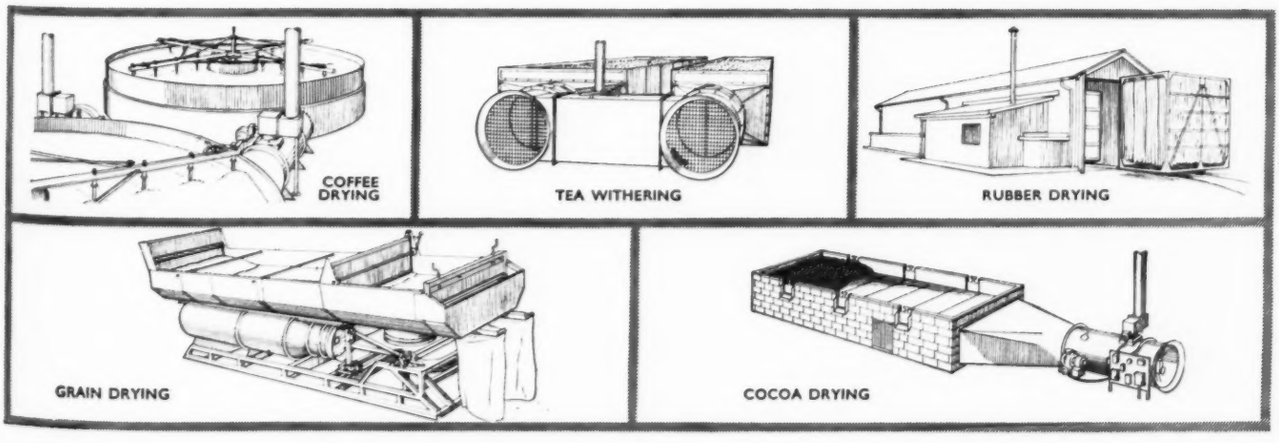
May we talk to you about it? We have world-wide representation.



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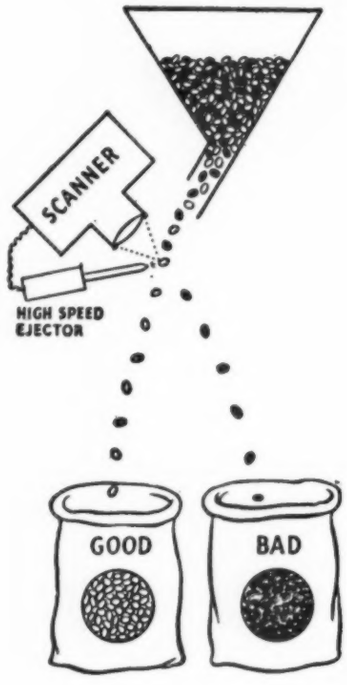

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COLOUR SEPARATION

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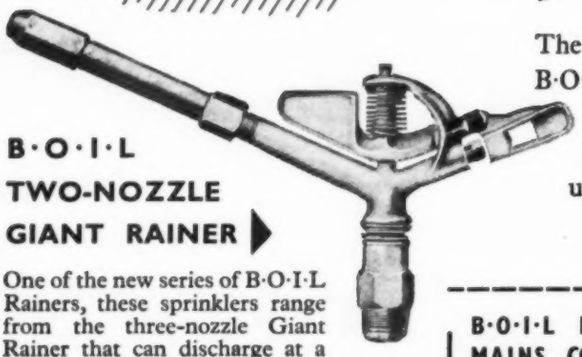

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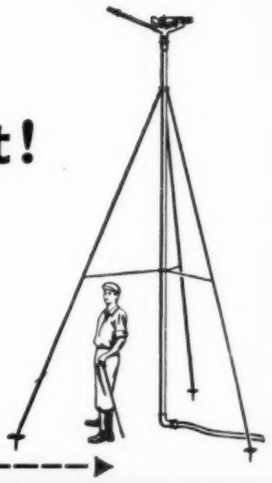

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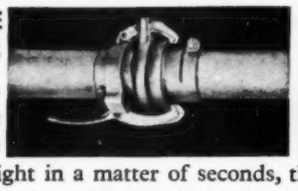

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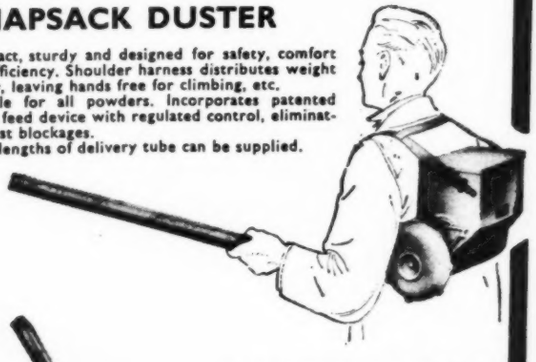

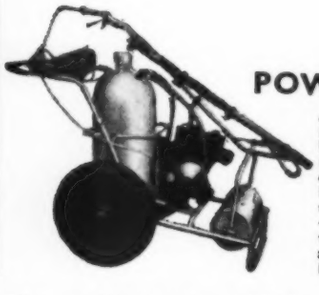

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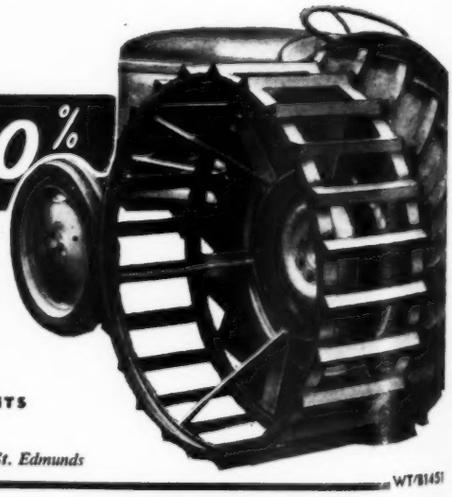

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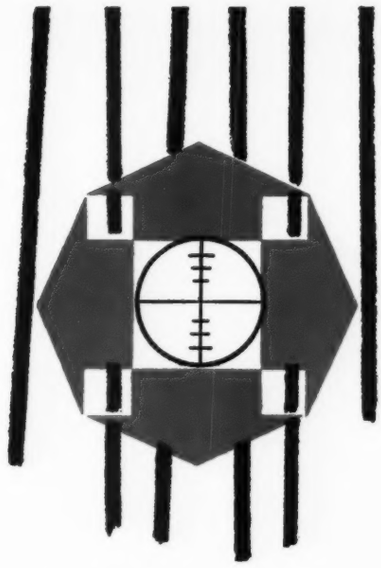

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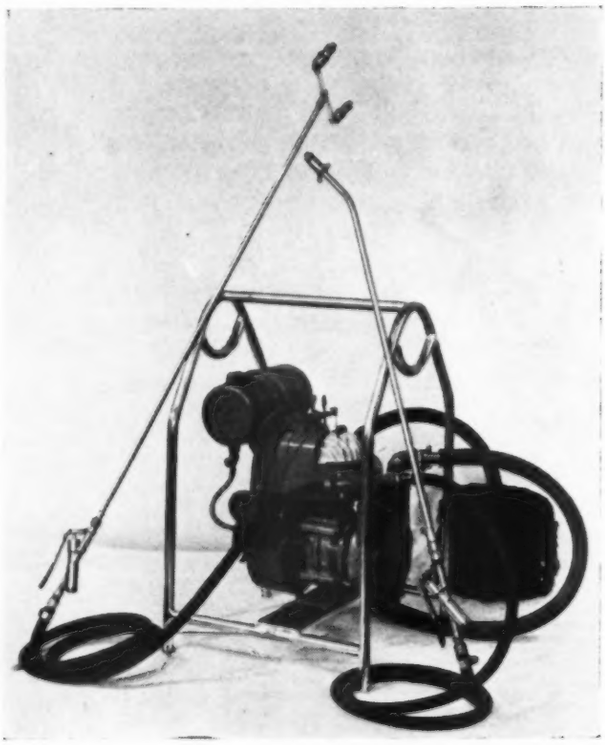

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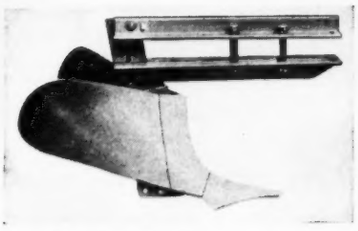

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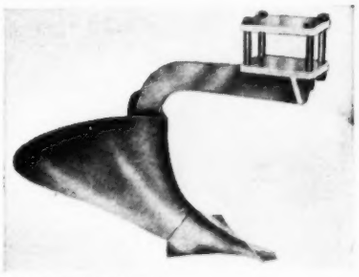

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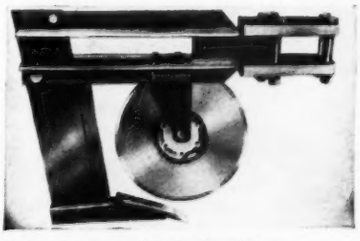

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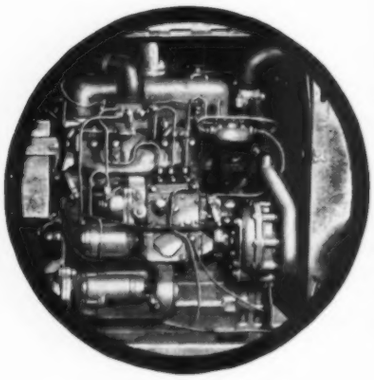

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WORLD CROPS

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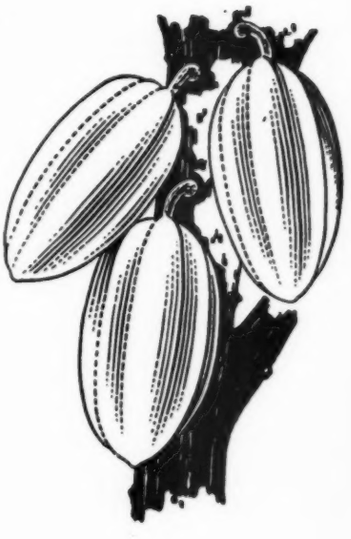

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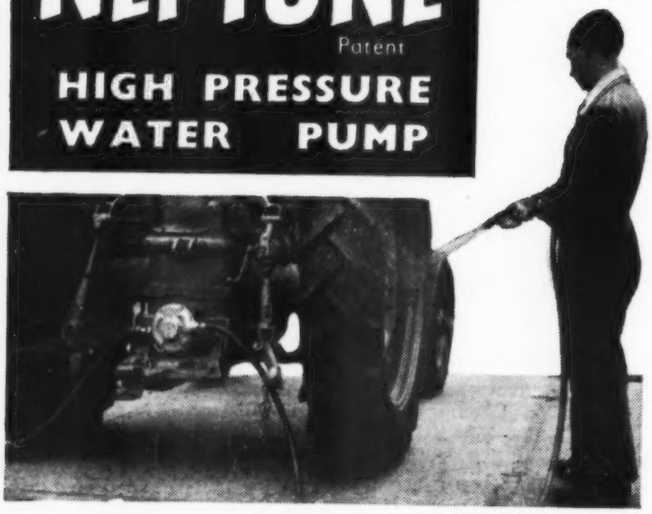

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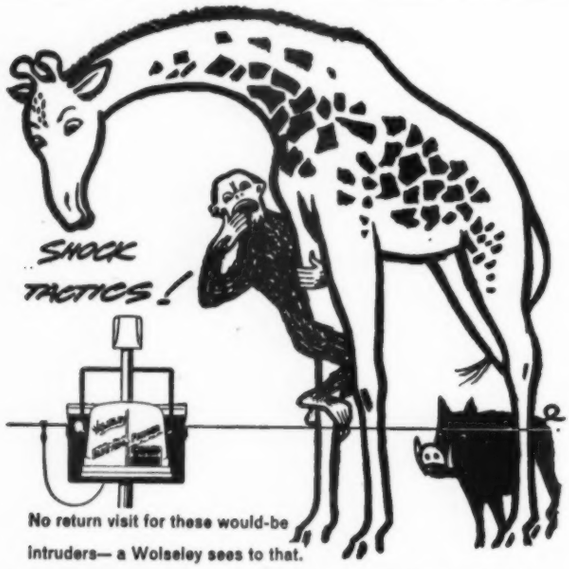

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Ref. A.837. British. Female. Single. Age 38. 1st and 2nd M.B. and Inter. B.A. (French, Greek, History and Logic). Experience includes 5 years teaching mathematics and science. 3 months translator, banking. 4 months editor, scientific translation. Fluent French and German. Seeks post as **SCIENTIFIC LIBRARIAN/SCIENTIFIC JOURNALIST/TECHNICAL TRANSLATOR/RESEARCH OR INFORMATION ASSISTANT.** London. £700 p.a.

Ref. A.838. British. Male. Married. Age 41. M.Sc. (Metallurgy). Professional qualifications in engineering, metallurgy and management. Author of wide range of technical papers. Has held technical staff appointments in the Services and senior industrial appointments concerned with chemical and methods engineering. At present chief chemist/metallurgist, manufacturing engineers. Seeks appointment as **TECHNICAL DIRECTOR/CHIEF CHEMIST/METALLURGIST.** England. £3,000 p.a.

Ref. A.839. British. Male. Married. Age 33. H.N.C. (Mech.). 5¾ years draughtsman, contract drawing office. 8 months draughtsman, steam equipment. 5¾ years design draughtsman, steelworks cranes and machinery. 1 year design draughtsman, ore-handling conveyors. 1 year offices stress engineer and 6 months senior design draughtsman, aircraft undercarriages. At present senior design engineer responsible to works director, general experimental and prototype engineering (special purpose machinery aircraft servicing equipment, test rigs, guided weapon launchers, aircraft ducting. Seeks post as **DESIGN OR MECHANICAL ENGINEER (IN LEADING OR EXECUTIVE CAPACITY) OR AS CHIEF DRAUGHTSMAN.** London, North Kent or East Surrey. £1,800 p.a.

Ref. A.840. British. Male. Married. Age 29. Joined R.N as artificer apprentice and is now engine room artificer, 1st Class (fitter and turner to trade), submarines. Experienced marine engineering. Leaving R.N. February 1961 and seeks **DIESEL OR HYDRAULIC ENGINEERING** post. U.K.—not London—or abroad. £1,000 p.a.

Ref. A.842. British. Male. Married. Age 46. Inter. B.Sc. (Eng.). 3 years draughtsman, fuel injection (diesel and automobile equipment). 2 years designer, precision instruments. 2 years designer, photographic apparatus. 7 months designer, gyroscopic apparatus. 3 years draughtsman, electrical engineering. 1 year designer, electrical engineering. At present mechanical designer, radar and electronics development and manufacture. Seeks post as **CHIEF DRAUGHTSMAN/DESIGNER/MECHANICAL ENGINEER,** West of England—preferably Cirencester, Oxford, Swindon districts—or S.W. Midlands, or would consider **TECHNICAL REPRESENTATION** based on these areas. £1,500 p.a.

Ref. A.843. British. Male. Married. Age 27. O.N.C. (Mech. Eng.). 3 months fitter's course and 9 months draughtsmanship course at Government training centre. 1 year trainee quantity surveyor, civil engineers. 3 years design draughtsman, diesel engine manufacturers. At present design draughtsman, domestic appliances manufacturers. Seeks post as **DESIGN DRAUGHTSMAN,** U.K.—not London—or Canada or S. America. £900 p.a.

Ref. A.844. British. Male. Married. Age 33. Full apprenticeship as boilermaker-welder and technical education to O.N.C. standard in marine engineering, machine drawing, workshop apprentice, mechanical and electrical. Now preparing for M.O.T. 2nd Class (Motor) Certificate of Competency. 17 years R.N. as engine room artificer, in charge running and maintenance air-conditioning and refrigeration plant, air compressors, hydraulic pumps, large diesel engines, boilers and turbo machinery. Seeks post as **MAINTENANCE OR PLANT FOREMAN,** U.K., preferably Bristol area. £1,100 p.a.

Ref. A.845. British. Male. Married. Age 40. M.O.T. 2nd Class (Steam). A.Inst.Mar.E. 4 years apprentice engineer, mechanical engineers. 12 years engineer in Merchant Navy up to and including chief engineer. 3½ years assistant engineer, mechanical and marine engineers. 2 years resident engineer, engineers, tug and barge owners and refrigeration stores. At present power-house engineer, woodworking all classes on large scale. Considerable experience running and maintenance steam turbines and water-tube boilers, diesel engines, pumping plant, refrigeration and air-conditioning plant. Seeks post as **MAINTENANCE OR MECHANICAL ENGINEER,** U.K. or abroad.

Ref. A.846. British. Male. Single. Age 23. H.N.C. (Applied Physics). At present employed in research laboratory, defence research. Seeks post as **DEVELOPMENT ENGINEER/TECHNICAL ASSISTANT**—preferably electronics—U.K. or abroad. £750 p.a.

Ref. A.847. British. Male. Married. Age 44. A.M.I.E.E., A.M.I.Loco.E. 3½ years trainee, rectification equipment with manufacturing electrical engineers. 6 years test, D.O. and design, manufacturer motors, geared units. 4 years electrical officer, R.N. 8 years design engineer, manufacturing electrical engineers (electric traction). 5 years senior design and development engineer in charge group, manufacturing electrical engineers. At present senior design and development engineer, electrical and mechanical engineers. Considerable experience visit to customers U.K. and abroad for technical discussion and to give operational and maintenance advice. Seeks post as **TECHNICAL MANAGER OR CHIEF ENGINEER, OR SIMILAR,** Birmingham or London. £2,500 p.a.

Ref. A.848. British. Male. Married. Age 39. M.O.T. Certificate of Service as 1st Class Engineer (Steam and Diesel). M.Inst.Mar.E. 23 years R.N., including 4½ years full apprenticeship as mechanical engineer. 8 years artificer. 11 years engineer officer. At present engineer lieutenant and leaving R.N. November 1960. Considerable diesel and steam experience and refitting and plant maintenance and planned maintenance experience. Seeks post as **ASSISTANT WORKS ENGINEER OR MAINTENANCE ENGINEER OR SHORE-BASED MARINE ENGINEER,** London or South Coast of England. £1,500 p.a.

Ref. A.849. French. Male. Married. Age 36. **RESIDENT U.K.** H.N.C. (Mech.). B.E.I. (French award). Bilingual English/French. 3 years design draughtsman, automotive engineers (car manufacturer). 1 year engineering draughtsman, hydraulic engineers contract D.O. 3 years engineering draughtsman, welding and flame-cutting equipment manufacturers. At present plant design engineer, light structural engineers. Considerable experience electro-mechanical devices and electrical circuits, hydraulic and pneumatic application—handling of complete project from cost justification to acceptance tests—team leading and D.O. management. Seeks post as **CHIEF ENGINEER (DESIGN) OR ENGINEER (PLANT MAINTENANCE),** Hertfordshire, N.W. London or France. £1,500/£2,000 p.a.

Ref. A.850. British. Male. Married. Age 34. 3½ years apprentice fitter and turner, sugar refiners. 2 years airframe fitter, R.A.F. 1 year maintenance fitter, sugar refiners. 5½ years maintenance fitter, ship repairers. 2½ years maintenance fitter, coal by-products refiners. 3½ years draughtsman, electrical and mechanical engineers. At present draughtsman, hospital equipment. Seeks post as **DRAUGHTSMAN,** East Anglia—preferably Norwich—area. £900 p.a.

Ref. A.852. British. Male. Single. Age 29. O.N.C. (Mech. Eng.). 10 years engineering assistant, chemical industries. At present inspection and liaison engineer, nuclear engineering. Seeks post as **PROGRESS/LIAISON ENGINEER,** Liverpool area. £1,100 p.a.

Ref. A.853. British. Male. Married. Age 35. Ex Grad. R.Ae.S., F.R.S.A. 2 years trainee in design and works, aircraft hydraulic engineers. 14 years design draughtsman, airframe and ground equipment. 3 months project designer, light engineering. 4 years in charge of production design and works liaison, airframe and equipment manufacturers. At present in charge of productions design office with aircraft manufacturers and designers. Considerable experience on mass production and works management. Seeks post as **DESIGN OFFICE MANAGER OR IN TECHNICAL LIAISON,** U.K.—not London—£1,500 p.a.

continued overleaf

To: I.S.I.S. Appointments Register, 9, Eden Street, London, N.W.1. Please ask the following applicants to communicate with the undersigned:

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Signature ..... Date .....

I.S.I.S. APPOINTMENTS REGISTER—*continued*

Ref. A.854. British. Male. Married. Age 26. H.N.C. (Elec.). Grad. I.E.E. 4 years student apprentice and 1 year assistant design engineer, electrical engineers. 2 years National Service as radio instructor. 1½ years design engineer, rectifier equipment. Seeks post as **ELECTRICAL ENGINEER**, Jamaica or S. Africa. £950 p.a. approx.

Ref. A.855. British. Male. Married. Age 26. O.N.C. (Mech. Engg.). 4 years apprenticeship, toolmaker and jig and tool draughtsman. 3¾ years die and model draughtsman, precision castings. At present design draughtsman, electro servo mechanisms and aircraft fuel systems. Considerable experience in precision foundries on investment casting work (small aircraft parts, turbine blades, etc.) and also interested in chemical engineering/plastics. Seeks post as **DESIGN DRAUGHTSMAN**, U.K., Canada, U.S.A. or Australia. £1,000 p.a.

Ref. A.856. British. Single. Age 19. G.C.E. Maths. and Physics. Experience includes 9 months junior salesman, truck and ladder manufacturers. At present accounts clerk, purveyors of petroleum spirit. Seeks post as **LABORATORY ASSISTANT**, London. £8 per week approx.

Ref. A.857. Indian. Male. Single. Age 30. **RESIDENT U.K.** B.Sc., H.N.C. (Mech. Engg.). 3¾ years junior planning engineer and 1 year senior planning engineer, locomotive manufacturers. 2 years post-graduate trainee, U.K. locomotive manufacturers. 5 years. mechanical engineering apprenticeship. At present design draughtsman, special purpose hydraulic equipment. Wide experience pre-production, processing, rate fixing, etc., in production engineering. Seeks post as **PLANNING ENGINEER**, England. £900 p.a.

Ref. A.858. British. Male. Married. Age 27. O.N.C. (Mech.). Studying for A.M.I.E.D. 5 years apprentice (engineering), precision instruments. 1 year engineer, precision instruments. 6 months experimental technician, aircraft manufacturer. 6 months experimental technician, press tools. 1½ years experimental technician, atomic energy research. At present cryogenics technician, nuclear research, in Switzerland. Seeks **EXPERIMENTAL OR DEVELOPMENT POST**, England or abroad, except Africa. £1,000 p.a. min.

Ref. A.859. British. Male. Married. Age 25. O.N.C.—2 years—(Elec. Engg.). Studying for H.N.C. (Elec. Engg.). 6 months trainee draughtsman, heating and lighting engineers. 4½ years technical clerk, Civil Service. 11 months draughtsman, signals. At present draughtsman, electrical and signal engineers. Seeks post as **DRAUGHTSMAN**, U.K., preferably London. £800 p.a.

Ref. A.860. British. Female. Married. Age 24. G.C.E. Chemistry and Science. 3 years laboratory assistant, medical school. At present research assistant, biochemical research. Wide experience analytical methods chromatography, coloremetric, Kjedahl Warburg assays. Seeks post as **TECHNICIAN**, preferably biochemical. Romford/Hornchurch, East London or City areas. £500/£600 p.a. approx.

Ref. A.861. British. Male. Married. Age 28. B.Sc. (Chem.). Since graduating has spent 1 year on research and 3 years on production, with short periods in charge small factory. At present process superintendent, fertiliser manufacturers. Seeks **EXECUTIVE/MANAGERIAL POST**, U.K., not London. £1,125 p.a.

Ref. A.862. British. Male. Married. Age 26. H.N.C. (Mech.). Apprenticeship as marine engine fitter. At present design draughtsman, marine engineers. Experience reciprocating air compressors and refrigeration. Seeks post as **DESIGN DRAUGHTSMAN**, U.K., not London. £18 per week.

Ref. A.863. British. Male. Single. Age 25. Mech. Sciences Tripos Part I (2nd Class). Vacation employment includes 3 months student engineer, consulting engineers. 3 months student trainee, papermaker. 3 months survey crewman, consulting engineers. At present graduate apprentice, heavy engineering. Seeks **PRODUCTION ENGINEERING POST**, London or abroad. £900 p.a.

Ref. A.864. British. Male. Married. Age 52. H.N.C. (Mech. Engg.). Diploma in Archaeology. A.M.I.Mech.E. 5 years student apprentice, city corporation. 9 years designer, engineers and instrument makers. 7 years chief designer, optical apparatus. 5 years chief designer, engineers. 6 years chief designer and manager of experimental workshop, optical apparatus. At present works manager, engineer and instrument makers. Can undertake styling of products in addition to design and productions. Accustomed complete responsibility of machinery design and production. Seeks post as **CHIEF ENGINEER/WORKS MANAGER OR DESIGNER**, London or Home Counties. £1,800 p.a.

Ref. A.865. British. Male. Single. Age 23. H.N.C. (Mech. Engg.), G.I.Mech.E. Studying for B.I.M. diploma. 2 years graduate apprenticeship, aircraft ancillaries. At present production assistant, aircraft ancillaries. Seeks post as **PRODUCTION ENGINEER OR POST LEADING TO WORK MANAGEMENT**, N.E. Middlesex. £800/£850 p.a.

Ref. A.866. British. Male. Married. Age 35. H.N.C. and endorsements. 7 years apprenticeship, aircraft and furniture manufacturers. 4 years design draughtsman, photo-copying machines. 4 years design draughtsman, duplicating machines. At present development engineer, manufacturers of oxy-acetylene cutting and welding equipment and machines. Seeks **DEVELOPMENT/DESIGN OR TECHNICAL REPRESENTATION APPOINTMENT**, N. and N.E. London, Ware, Hertford or Harlow areas. £1,100 p.a. approx.

Ref. A.867. British. Male. Married. Age 29. B.Sc. (Eng.), D.I.C., A.M.I.C.E., A.M.Inst.H.E. 4 months assistant R.E., county council. 7¾ years assistant civil engineer, Government department. 4 months site engineer, civil engineering contractors. At present design engineer, civil engineering contractor. Seeks **CIVIL ENGINEERING POST**, e.g. with civil engineering contractor as project engineer/assistant to contract manager, or with civil engineering consultant or consulting engineer, directly responsible to partner, or with industrial firm responsible for buildings and services. U.K., preferably London. £1,300 p.a. approx.

Ref. A.868. British. Male. Married. Age 40. Ground Engineering Certificates. B.Sc. (Eng.), F.S.A. (Scot.). 3 years planning and production engineer, aeronautical engineers. 1 year chief tool draughtsman, pressings, moulds, rubber and plastic and metal components. 1 year production engineer, electro-mechanical assemblies. 7 years senior tool designer/planning and production engineer, heating and ventilating engineers. 2 years assistant production manager, metal pressings and fabrications. At present tool design consultant/assistant works manager, precision tools. Seeks post as **WORKS OR GENERAL MANAGER OR PRODUCTION MANAGER**, London or Scotland preferred. £1,750/£2,000 p.a.

Ref. A.869. British. Male. Single. Age 32. O.N.C. and H.N.C. (Mech.) and O.N.C. (Elect.) and endorsements, G.Inst.Mech.E. 2 years trainee, builders' merchants. 4 years engineer, car manufacturers. 2 years personal assistant to the manager, consultant mechanical engineers. At present technical mechanical liaison engineer, guided missile manufacturers. Seeks **ENGINEERING MANAGEMENT OR JUNIOR TRAINEE POST**, London or U.S.A £1,100 p.a.

Ref. A.870. British. Male. Married. Age 35. Diploma in Public Administration (London Univ.), B.Sc. (Economics). Experience includes 4¾ years assistant (clerical), electricity distribution. 1½ years costing clerk, electricity distribution. 6½ years electricity generations and supply, responsible for personnel and establishments administration, printing, stationery, form control, office machinery and equipment. Seeks **MANAGERIAL (PERSONNEL OR ADMINISTRATION) POST**, U.K., not London. £1,400 p.a.

Ref. A.871. British. Male. Married. Age 26. 4 years airframe fitter. 1½ years tool room work, motor vehicle manufacturers. At present storekeeper-buyer, auto research engineer, complete charge of large stores and majority of buying. Seeks post as **BUYER**, U.K. £15 per week.

Ref. A.872. British. Male. Single. Age 23. O.N.C. and H.N.C. and endorsements. 3 years general machine shop training. 2 years planning experience and at present jig and tool draughtsman, precision machine-tool engineers. Seeks post **WITH CONSULTANT PRODUCTION ENGINEERS**, U.K.

Ref. A.873. British. Male. Single. Age 28. O.N.C. 1½ years design draughtsman and section leader, hydraulic pumps and test rigs and special machines. 1 year design draughtsman, contract design office. At present contract draughtsman (on loan), motor car manufacturers, design and supervision of installation on site of specialised melting and hot metal handling equipment and general mechanical handling of materials. Seeks post as **DESIGN DRAUGHTSMAN**, London or Kent. £1,200 p.a.

Ref. A.874. British. Male. Married. Age 30. B.Sc. (Physics and Maths. with some Chemistry). 3 years trials engineer (telemetry), guided weapons. At present systems engineer (nucleonics), electronic instrumentation. Seeks post as **ENGINEER (ELECTRONICS, ETC.)**, Gloucester, Wilts, Somerset, Dorset, Oxon, West Berks, West Hampshire areas. £950/£1,050 p.a.

Ref. A.875. British. Male. Married. Age 32. B.A. (Maths.) (Cantab.), M.A., B.Sc. Special (Hons. Maths.). 1½ years administrative work, meteorology and aviation. 3 years group leader of team of scientists, guided missiles. 5 years instructor lieutenant (R.N.) (meteorologist). Fluent Spanish and French, some Italian and German. Seeks post as **MATHEMATICIAN/METEOROLOGIST OR REPRESENTATIVE.** Preferably tropics or sub-tropics. £1,100 p.a. min.

Ref. A.876. British. Male. Single. Age 23. G.C.E. 'A' level Advanced Physics, Chemistry, Pure Maths. Higher Physics to B.Sc. general standard. Chemistry Diploma to A.R.I.C. II standard. 3 months assistant in research laboratory, resin manufacturers. 5 years technical staff trainee, electricity board. At present engaged in control operation work—refinery, oil operation department, oil production and refining. Seeks **SUPERVISORY POST LEADING TO MANAGEMENT**, S. America, Central America or Caribbean. £1,200 p.a.

Ref. A.877. British. Male. Single. Age 22. H.N.C. (Mech.) and studying for G.I.Mech.E. 5 years student apprentice, aircraft. At present development engineer, filtration and silencing engineering. Seeks post as **MECHANICAL DESIGN ENGINEER**, U.K. £650 p.a.

Ref. A.878. British. Male. Married. Age 37. O.N.C. (Chem.). Assoc. M.C.T. 3 years junior chemist, coal-tar and oil distillers. 8 years technologist in charge powder metallurgy processes, powder metallurgy and non-ferrous wire manufacturers. 9 years' experience of plant used in heavy chemical industry, contract engineering, plant commissioning and provision of technical service to clients. At present sales and contracts engineer, engineering organisations. Seeks appointment as **PLANT OR PROCESS SUPERINTENDENT OR CONTRACTS ENGINEER**, U.K. £1,100 p.a.

Ref. A.879. British. Male. Single. Age 22. H.N.C. (Mech.). Apprenticeship in heavy mechanical engineering. At present junior draughtsman, heavy mechanical engineering. Seeks post as **ASSISTANT ENGINEER (MECHANICAL)**, London. £15/£16 per week.

Ref. A.880. British. Male. Married. Age 30. H.N.C. (Elect. Engg.). 1 year learner fitter, general metalwork. 3 years assistant electrician, repair, installation of electricity plant. 5 years technician, light electro-mechanical apparatus development and manufacturers. 2 years design draughtsman, aircraft manufacturer and guided missile development. At present senior design draughtsman, precision instruments (electro-mechanical). Seeks post as **DESIGN OR PROJECT ENGINEER**, Surrey, Berks, Bucks or Hampshire. £1,250 p.a.

Ref. A.881. British. Male. Married. Age 26. A.M.R.I.N.A., H.N.C. (Naval Architecture) with endorsements in shipyard practice and organisation, advanced theory and design. 5 years apprentice and 3 years ship's draughtsman, shipbuilders and engineers. Seeks post with **GOOD PROSPECTS OF LEAVING DRAWING BOARD AND DEALING WITH PRACTICAL ASPECTS OF SHIPBUILDING**, U.K. £18 per week.

Ref. A.883. British. Male. Married. Age 28. O.N.C. and H.N.C. (Mech. Engg.) with all endorsements for A.M.I.Mech.E. Student of Inst. of Mech. Engg. and Grad. applied for. 5½ years apprentice, manufacturers of lighting fittings, heaters and general engineers. At present design engineer, design manufacturer, and maintenance of variety of ground handling equipment for guided missiles. Interested in any position related to **MECHANICAL ENGINEERING, ESPECIALLY WITH OIL OR MINING COMPANY, AND PREPARED TO UNDERGO TRAINING.** Abroad—any country considered. £1,300/£1,400 p.a. approx.

Ref. A.885. British. Male. Married. Age 38. D.L.C. 2nd Class Hons. Civil engineering. A.M.I.C.E. 10 months senior site engineer, civil engineering contractor. 1½ years resident engineer, staff, nuclear power plant. 2½ years senior site engineer, civil engineering and building contractors. 1 year hydro-electric design office, civil engineering consultants. 6 years assistant divisional engineer (4 years on hydrological survey), Sudan irrigation department. At present senior engineer on river improvement contract, civil engineering contractors. Seeks post as **CIVIL ENGINEER OR HYDROLOGIST.** Will consider any locality. £1,250 p.a. min.

Ref. A.888. British. Male. Married. Age 51. S.C.P., M.S.A.E., M.B.A.M.E. Very considerable experience of internal combustion engine design work, the application of electronic principles to the automobile industry as research and development engineer and as a consultant. At present employed as independent consultant. Seeks appointment as **SENIOR DESIGNER / DEVELOPMENT ENGINEER**, U.K., Europe or America. £1,500 p.a. min.

Ref. A.889. British. Male. Married. Age 34. 2 years machine shop foreman, watch manufacturers. 10 years assembly foreman, watch manufacturers. Experience in production and administrative side of mass production in batch systems and flow-line systems. Seeks **PRODUCTION ENGINEERING POST**, U.K., not London. £1,200 p.a.

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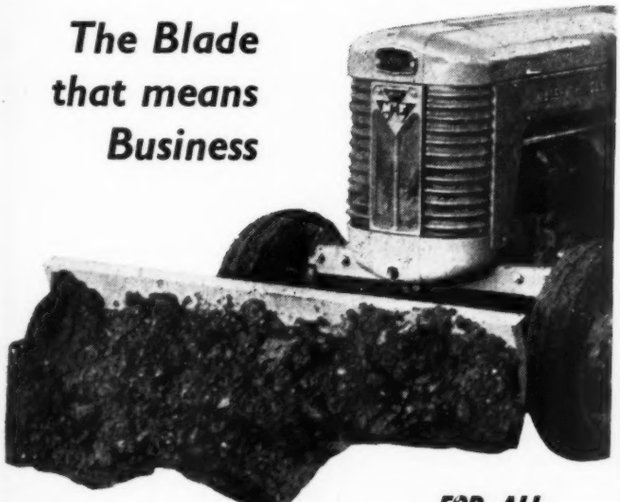

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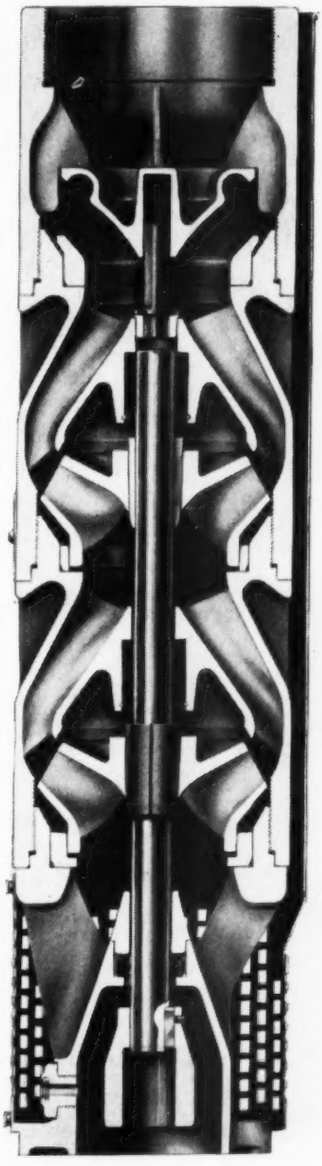

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